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Building Hydraulic Turbines of Unusual Size

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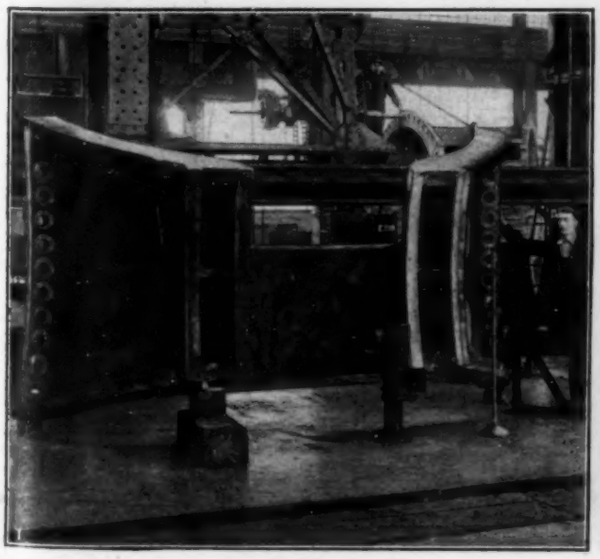
A lay-out plate exceptionally large—Heavy machine tools of various kinds—Taking portable machines to the work—Balancing rotating parts of great weight

THE outstanding feature of the Dominion Engineering Works plant near Montreal, Can., is the splendid equipment of large machine tools and the immense size of some of the turbines under construction. They may, perhaps, be compared to ordinary tools and work, seen through a huge magnifying glass. It must be remembered that big work is heavy, and necessitates big cranes and other handling facilities. The illustrations give some idea of the size of the machines and that of the work they handle.

The hydraulic machine and erection floor is located next to the foundry where the large castings are made, so that the movement of material is reduced to a minimum. The marking-off table is located three inches above the floor level and is 40 ft. long and 14 ft. wide. The machine tools are large but, nevertheless, just as accurate as their smaller brothers. For while the work is big, the tolerances are in thousandths of an inch, because each part has to fit its neighbor correctly.

In Fig. 1 is shown a section of a spiral casing for a hydraulic turbine on the marking table. When we realize that two other castings have to fit against the drilled flanges in order to complete the circle, the whole forming segment a of a complete spiral casing, it will be seen that methods different from the ordinary have to be employed. Here is a problem, where some of the much abused, poor old trigonometry comes in very handy. Fig. 2 shows the casing completely assembled for the boring operation. It also shows how the staggered joints of the sections at *A*, *B*, etc. join up with the piece shown in Fig. 1. These joints are staggered to obviate the four castings joining at one point.

It is obvious that one cannot employ trial methods with castings of this size, and that many intricate lay-



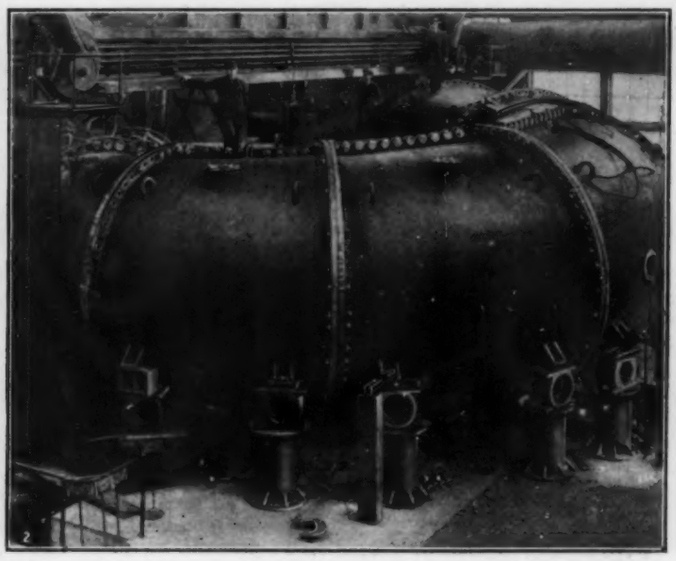
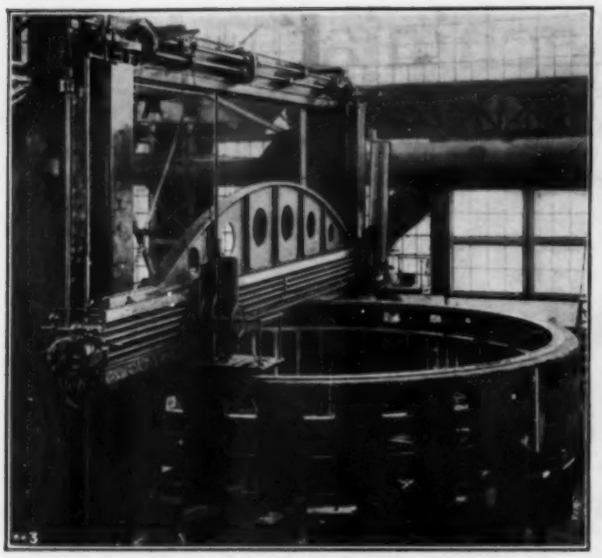
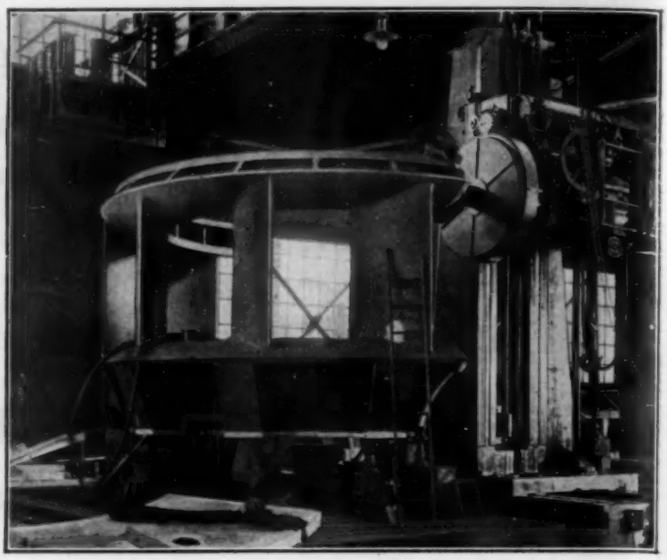
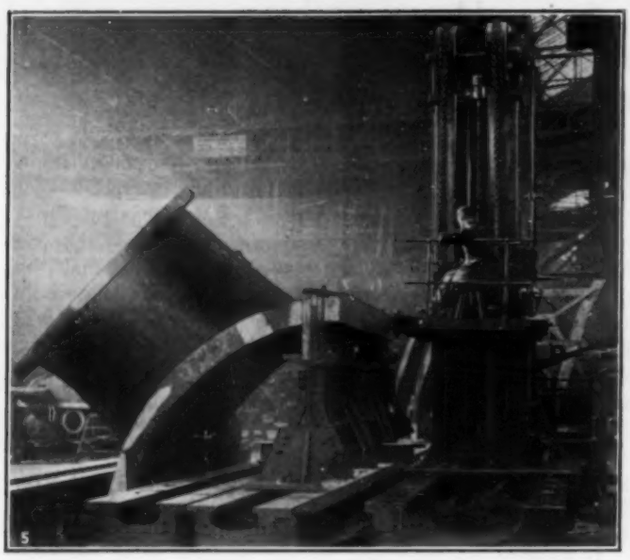
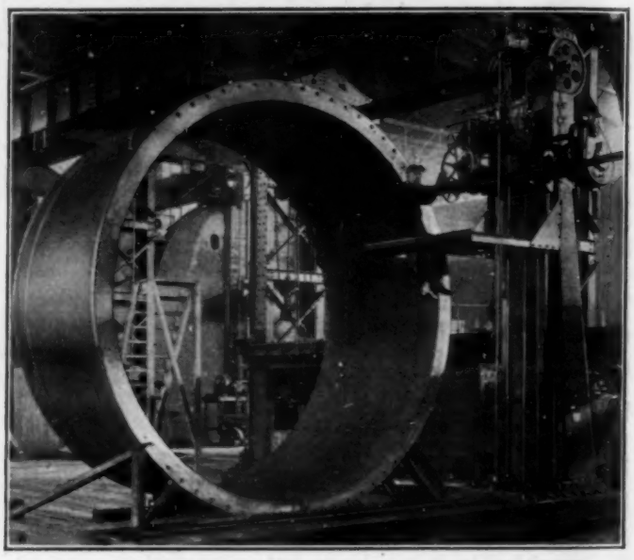


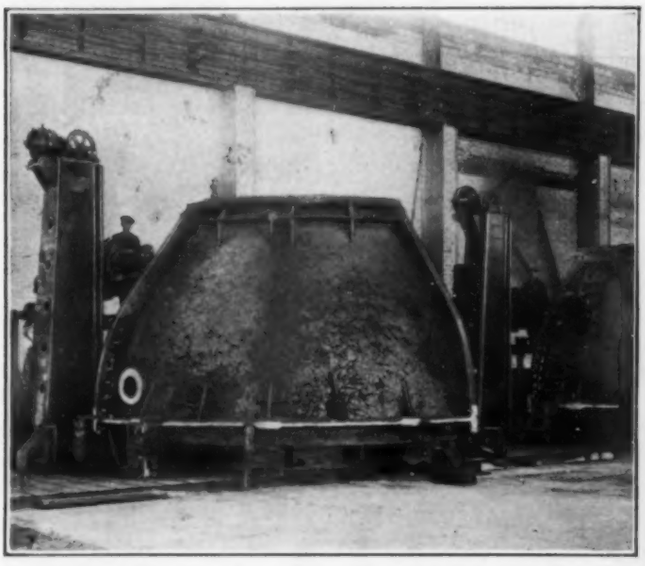
Fig. 1—The marking or laying-out table. Fig. 2—Boring a large turbine casing











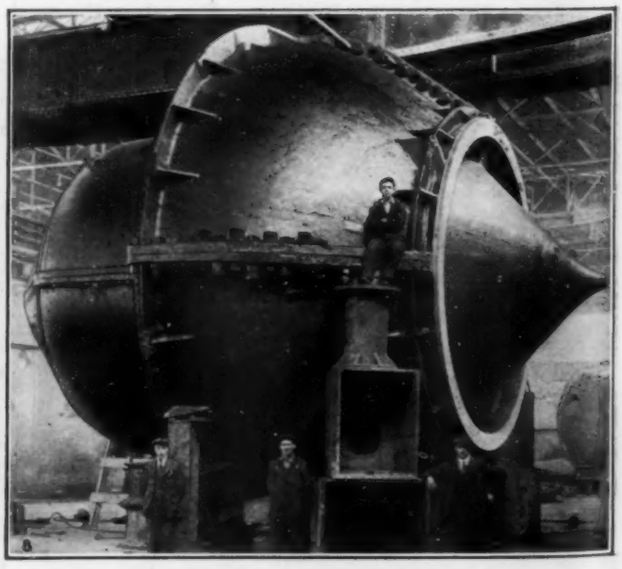


Fig. 3—Boring stator frame on 30-ft. mill. Fig. 4—Milling face of speed ring. Fig. 5—Planing casing joints. Fig. 6—Drilling large test ring. Fig. 7—Milling and drilling valve parts. Fig. 8—20-ft. valve on erecting floor.

out problems come up from time to time. The operation shown in Fig. 2 is an unusual one. The immense weight of the casing, outside of the physical or size restriction, precludes its being bored on the boring mill in the usual way. This casing, which is for a 41,000-hp. turbine, now in operation, was assembled around the table of the Sellers boring mill shown and the regular heads on the crossrail were run back out of the way. Special tool heads were suitably set up on the table and rotated as boring bars inside a hole. The capacity of this boring mill is 35 ft. in diameter between housings and 18 ft. high under the crossrail, which is 41 ft. long. So far as known there is but one other mill of this size on the American continent. The tool bar traverse is 7 ft., the whole machine being under push button control from either platform.

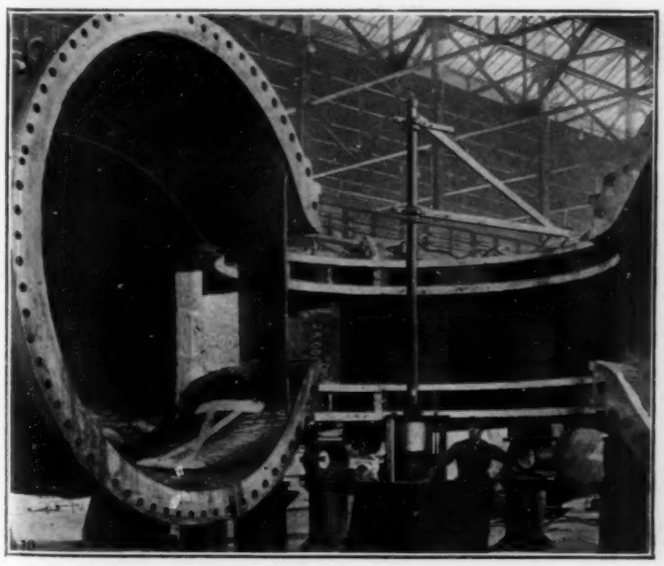
A better view of this machine is shown in Fig. 3, where a large stator frame is being bored and faced in the regular way. These pictures do not give the reader the correct perspective, because, in order to see the details, the photographer had to get high up in the air. They do, however, give a general idea of the machines and the work.

The Hulse floor boring machine, shown in Fig. 4, is milling the joints of a hydraulic-turbine speed ring. This machine has a 10-in. spindle and has great capacity for heavy cutting. At the lower left-hand corner can be seen the rails for the outboard bearing which supports a 20-ft. long boring bar and housing, not shown. The head has a vertical movement of 11 ft., and a horizontal traverse of 24 ft. The main problem on this machine is to hold the job still, which is not nearly so easy as it looks. The blocking, jacks and holding-down bolts show the methods used.

Shaft turning is done in a regular Niles-Bement-Pond shafting lathe. Turbine shafts often weigh 25 tons each and the handling of this class of work calls for special training if any time is to be made on the job.

The Buckton slotting machine shown in Fig. 5 is another machine of particular interest. It has a toolhead like a slotting machine and carries two tools, one to cut in each direction. By an electric control arrangement, the cutting can be done either in a horizontal plane as illustrated, where the whole column traverses back and forth on the bed, or in a vertical plane, where the operator and carriage traverse up and down the column. In the latter case the column is locked on the bed. The horizontal stroke of this machine is 10 ft. and the vertical stroke the same. It will be seen that there is practically no size limit to the work that can be handled on this machine. The special blocking, built up from castings, angles and an I-beam, is of interest. In Fig. 6 is shown a Pawling and Harnischfeger floor drilling machine of the latest design which does very fast and accurate work. The casting shown is a test barrel for the casing seen in Fig. 2. This barrel is a

Fig. 9—Balancing large runner



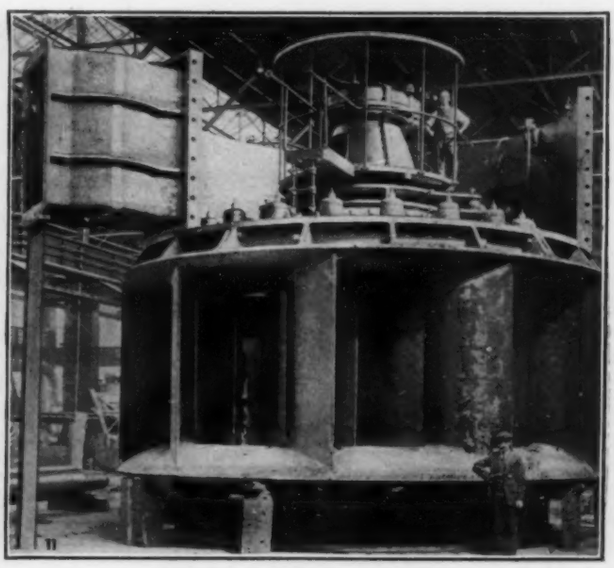
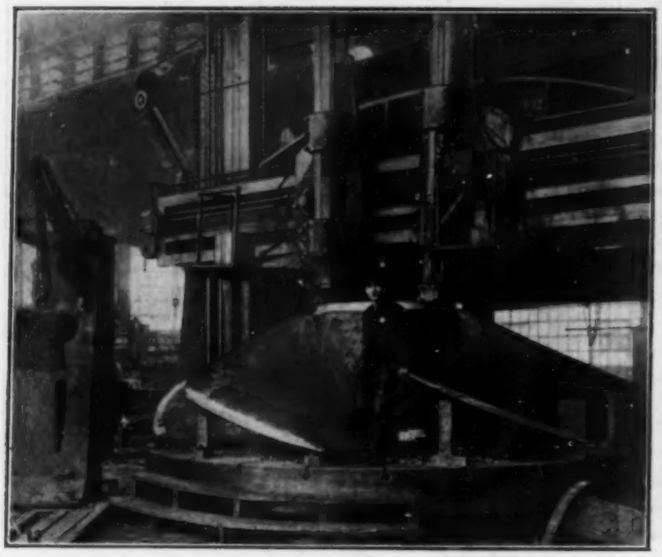


Fig. 10—Erecting 41,000-hp. turbine. *Fig. 11—Another large turbine on floor*



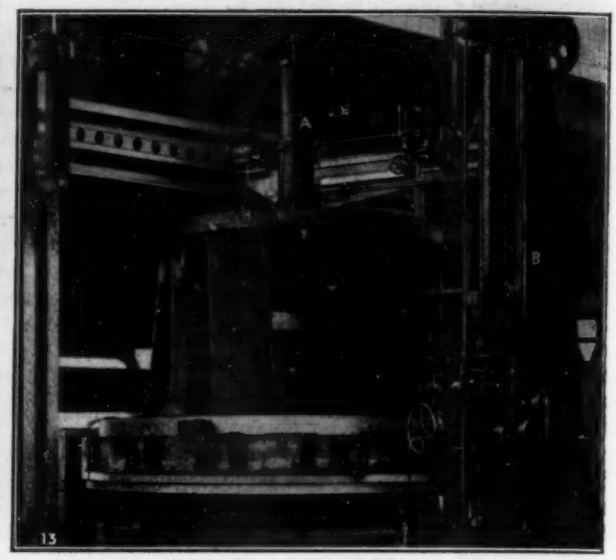


Fig. 12—Turning and boring large runner. Fig. 13—A Francis type runner

shop fixture and is used only for blanking off the inside bore of the sectional spiral casing in the same manner as a blank flange is put on the end of a pipe for hydrostatic test. Fig. 6 shows how, with the proper machines, work of this size and character becomes simple.

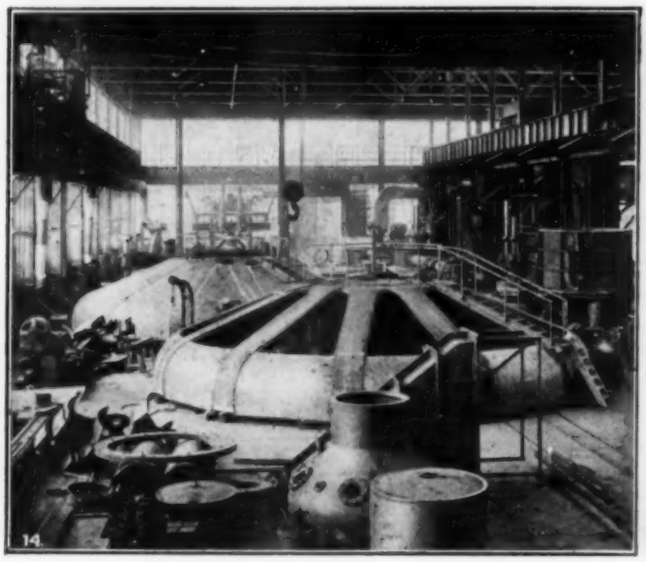
Milling the joints faces on large valves is done on two Detrick & Harvey portable milling machines that are mounted on a bed 45 ft. long. Fig. 7 shows two quarter sections of a 20-ft. Larner-Johnson valve being faced at the joints on these machines, the spindles of which are 5 in. in diameter. Fig. 8 shows a Larner-Johnson valve partly assembled on the erecting floor and gives a good idea of its size.

Among the floor operations that require special study, is the balancing of waterwheel runners. Fig. 9 shows an 11,300 hp. runner on the balancing mandrel. This runner is built up of four cast-iron sections, each casting weighing 16 tons and including a steel band and a steel crown plate, the complete runner weighs over 64 tons. Roller bearings are used for the balancing operation instead of the regular plain bearings. Note the way in which the bearing support is built up.

Since all turbines must be erected in the shop, the handling of pieces of such ungainly sizes and shapes calls for considerable judgment, and experience counts for much. One cannot tie up a 70-ton crane for long at one time without causing trouble and delays in other departments. So the floor boss has to set his rigging just about right, lay out the shop floor right and provide means so that he will know the work is "coming right" all the time.

A typical erection of a 41,000 hp. turbine is shown in progress in Fig. 10 and is of more than ordinary interest. The central column and the swinging arm act as a circular tram. Fig. 11 shows another such turbine in the course of erection on the shop floor. This turbine is 11,300 hp. Figs. 10 and 11 give a good idea of size of the work when compared with the men in the picture.

A Niles 18-ft. boring mill of the regular type is shown in Fig. 12, machining a high-speed turbine



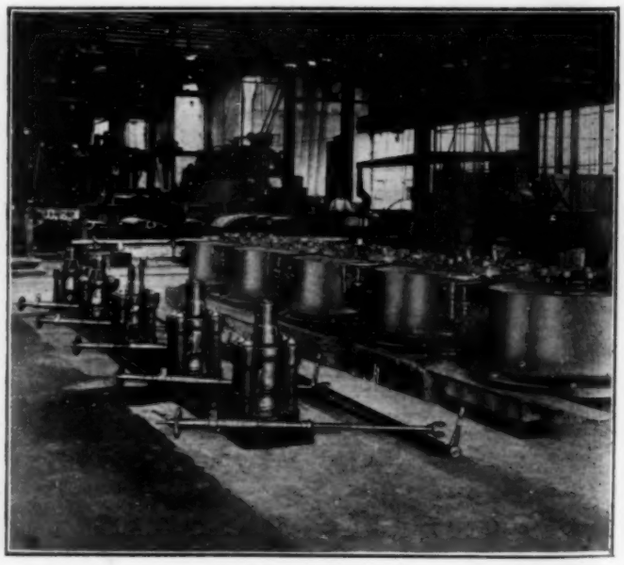


Fig. 14—Thrust decks for turbines. Fig. 15—Governor parts of turbines

runner that develops over 28,000 hp. It will be noted that an extra toolpost has been set up on a separate base *A*, outside the mill proper, in order to perform a special operation. On account of the edge of the propeller blades being so thin, it cannot be easily seen that they are turned concave so as to fit into a ring that has an internal convex radius, but such is the case. The extra tool post carries a radius attachment at *B*, for locating and turning the exact radius required.

A Francis type runner that has just been completely turned on this same 18-ft. mill, is shown in Fig. 13. After turning, the runner band is put on and the crown plate is placed on the top. Since this runner is in four sections, it is absolutely necessary that the exact relation of parts be maintained, because it has to be separted for shipment. Consequently, the locating dowels and bolts must be accurate and as easily reached as possible. A portable radial drilling machine will be seen mounted on the top of the runner at *A*, and a Pawling and Harnischfeger drilling machine at *B*, is set up temporarily on the floor in order to handle this work.

A general view of assembly floor No. 2 is seen in Fig. 14, showing some large thrust decks in the course of construction. These are the parts that are seen usually on the operating floor in power houses, the turbines themselves being always underground. Another view, Fig. 15, shows some smaller work pertaining to the governor mechanism of the large turbines at Niagara Falls.

While the large work shown is a feature of hydraulic turbine manufacture, there are multitudinous small parts to be taken care of which call for ordinary sized machinery. Some little idea of such work may be had from the last illustration.

Maintaining Interchangeability

IN A pair of mating parts that move freely, there is a space or clearance between the mating surfaces. This space is large or small, according to whether the fit is loose or tight. If this space be gradually reduced, a condition will ultimately be reached in which there is no space or clearance between mating surfaces; that is they fit metal to metal without shake. Then any movement of the parts one within the other will require some force, and if the surfaces are accurate and smooth, both members are of the same size. When this condition of mating parts exists, then the dimensions of the parts making this fit should be the exact standard or basic value.

This zero line is then the place at which interference of metal begins to take place, and the zero line should represent the exact standard or basic value of the dimension because a correct pair of mating standard gages checks the dimensions of a pair of mating parts against interference. This means that the minimum dimension, because a correct pair of mating standard dimension of the internal member of a pair of mating parts that fit without shake, are standard or basic.

This fit without shake is the hardest to make and standard gages bought in the open market are the "go gages" for this fit and immediately check an interference of metal.

Strict interchangeability can be maintained only when the interference of metal or zero line, between mating parts, takes place at a fixed relation to the basic or standard dimension.

This is so obvious that it scarcely even needs explanation. It must be plain that if every locality and every country agreed that the zero or interference line should be 0.001 in. over basic and worked to this system, interchangeability could be maintained.

Cases that Would Defeat Interchangeability

It must be equally plain that if one locality or country adopted the plan of having the zero line or point at which interference takes place 0.001 in. over basic or standard, another 0.001 in. below basic or standard, and still another at a point exactly agreeing with basic or standard, there could be no strict interchangeability in mating parts among these three countries.

Such a condition is exactly analogous to a variation in the values of standards. Suppose the American inch was 0.001 in. smaller than the British and 0.002 in. smaller than the French, interchangeability of product among these countries would be lost, the product nearly worthless, the economy aimed at lost because the product would have to be special for each country, and the low cost due to quantity production unrealized.

It is impossible in my judgment to put too much emphasis on the basic or fundamental fact that, where interchangeability is desired there must be *a fixed and unchanging point in relation to the basic or standard at which the interference of metal takes place.* The master gages or standard gages of nominal sizes ordinarily available everywhere, conform to the fundamental that they are produced under ideal conditions and are identical within any limits now being discussed. A system dependent directly on these standard gages for checking the wear limit of the "go gages" is inherently superior to one dependent on another set of master gages whose limits are at variance with the standard gages of nominal sizes.

The Unilateral System of tolerances complies exactly with this basic principle.

The Bilateral System of tolerances violates this basic principle.

Strict interchangeability demands control of the dimensions of the minimum external and maximum internal members. If the interference of metal is intentional, as in tight fits, control of these two dimensions is also the important factor as well as in free fits, in order to prevent the assembly of mating parts that are too tight. There should be no confusion or misunderstanding in regard to the assembly of mating parts by interchangeable manufacture—the parts will assemble and function when no external member is smaller than the prescribed limit and no internal member is larger than the prescribed limit. If a system is set up which intends the use of worn gages, these basic truths are cast aside, because gages do not wear uniformly in either size or contour and hence cannot control either limiting dimension when worn.

It is a delusion to think that either on account of gage wear, gage tolerance, or for any other reason, the zero point can be crossed without destroying practical and economical interchangeability.

For analysis and comparison I will use a hole for three classes of fit: Snug 1 in. $\pm$0.0005, free 1 in. $\pm$0.001, loose 1 in. $\pm$0.002 in. as dimensioned by the Bilateral System. A glance indicates immediately three

From address by Col. E. C. Peck before the Cleveland Engineering Society.

minimum holes as well as three maximum. The zero point or interference of metal takes place respectively 0.0005 in., 0.001 in. and 0.002 in. below the basic size 1.0000 in. This will require three "go gages" none of which are basic, all of which are special. The pieces made in large quantities will have to be kept stored separately to obtain the kind of fit desired and prevent an interference of metal with shafts made for a higher grade of work than mated for where the minimum hole occurs.

These gages cannot be handed down to the next succeeding poorer grade of fit without refinishing because they will be worn taper. There will also be the cost of re-marking for the new class of fits. The same may be said of solid reamers From the largest solid reamer that could be used to the smallest for all three fits before it is thrown away there is a wear of 0.004 in. under ideal conditions.

Using the same examples by the Unilateral System the hole dimensions are:

Snug fit 1 in. $\pm$0.001 in., free 1 in. $^{+0.002}_{-0.000}$ in., loose fit 1 in. $^{+0.004}_{-0.000}$ in. We have at once one uniform minimum hole and that is basic 1.0000 in. The standard 1-in. plug is the "go gage" for all three classes of fits. The interference of metal takes place at the same unvarying zero point, the basic dimension. There is required one standard gage for the "go gage" which can be bought in the open market, for all three fits as against three special "go gages" by the Bilateral System. There is no difference in gage cost in either system for the "no go gages."

In manufacture the holes are quite commonly, and may well be, made with the same tools; inspection will pass, in either system, all holes which the "no go gage" for the snug fit class will not enter.

In the Unilateral System if the same "go gage" accepts all of these pieces as well, every one of them can be used for interchangeable assembly for any one of the three classes of fits without further classification. In the Bilateral System three inspections with three different "go gages" will have to be made and the holes belonging to each class of fit kept separate with attendant trouble and losses.

It is claimed by the opponents of the Unilateral System that the above mentioned inspection will pass more pieces by the Bilateral System, but this is not true as a little thought will show. The machining ability of the operator being equal in each case, the same number will be passed by each system as the extreme tolerance limits are the same—0.004 in. in either case.

Japan's Rapid Recovery from Disaster

Japan's trade relations with the United States are particularly close and the importance of this trade to both countries can hardly be overemphasized. The United States has consistently been Japan's best customer and her chief source of supply, in 1923 taking 43 per cent in value of her exports, and providing 25 per cent of her imports. In the twelve months ended Nov. 30, 1923, according to United States trade figures, the United States sold $247,000,000 worth of goods to Japan, and bought $347,000,000 worth from her. The United Kingdom, Canada, France and Germany were the only countries to which the United States sold more, and the United Kingdom, Canada and Cuba were the only countries from which the United States bought more. American exports to Japan in this period were over 90 per cent as great as American exports to all of South America.

The earthquake and fire of Sept. 1 to 3, 1923, in Tokio, Yokohama and neighboring districts, were unprecedented in their extent and in the loss of life and damage to property which they occasioned. The last previous earthquake in any degree comparable with the recent one, took place in 1854, about 70 years ago, and was not nearly as serious as the recent one.

Although the seriousness of the recent earthquake and fire should not be minimized, yet it should be realized that the area affected was but a small part of the Japanese Empire and in the main a center of consumption, rather than of production. Fatalities were less than one-eighth of 1 per cent of the population of the Japanese Empire and the estimated property loss less than 3 per cent of the total estimated wealth of the Empire. Practically none of the silk filatures (where the silk is reeled from the cocoons) were in the damaged territory and the effect on Japan's premier export industry has been only temporary. Only about 10 per cent of the country's cotton spindles were destroyed by the earthquake and fire.

Japanese authorities and the people of the damaged areas have attacked the problems of restoration of living conditions with the vigor characteristic of their race. As an indication of the progress already made, in Tokio, by the end of September, electric light service had been entirely restored; by the end of October, gas service had been restored in most parts of the city; and by the end of December the same could be said for the city's water supply. At the end of the year, four months after the earthquake, street railway service was 70 per cent of normal, and practically all the railroad lines are now functioning. In a word, communications and public services are now in working order.

It is well known that the rapid industrial and commercial development of Japan during the past thirty years has been one of the outstanding features of this period. Cotton spinning, the chemical industry and the electrical supply business were early developed. During the war, conditions gave rise to a period of unprecedented activity in which expansion in shipbuilding and in the manufacture of iron and steel products and machinery were especially prominent.

The formulation of general plans for the complete restoration of the damaged areas, has been placed in the hands of a Capital Restoration Board composed of representative men and headed by the Prime Minister. Under the direction of the Ministry of Home Affairs, which is now charged with responsibility for the execution of these plans, Tokio and Yokohama will be rebuilt, with buildings of modern types of construction and far superior in every way to the old cities. In Tokio, a new capital, suitable to modern requirements, with well-planned highway and rapid transit systems, waterways, parks and civic improvements will be laid out. Yokohama, according to present plans, will be rebuilt as a modern seaport, completely equipped with all of the best features to be found in the various ports of the world. The capacity of the Japanese people for industry and trade has been only slightly and temporarily affected; the actual loss due to damage and destruction of property will be made good in a comparatively short period by the energy and thrift of the Japanese people.

Hollow Connecting Rods in the Making

By Fred H. Colvin
Editor, *American Machinist*

The second article—Unusual construction of the inner rod and methods by which it is machined —The design resembles the marine type of rod

THE construction of the inner rod used in the Wright aeronautical engines is most unusual and resembles somewhat the marine type of connecting rod, as the bearings are bolted to the rod itself. A study of Figs. 10 and 1 will show the points in which this rod both resembles and differs from the outer or mating rod. As will be seen, the rod itself ends at the bearing which is connected to it by through bolts, as in marine construction.

The shank of the rod is drilled and reamed, all tool marks being eliminated and the eccentricity of the hole must not exceed 0.025 in. Another important point in this rod is that the places where it and the bearing meet must be in the same plane and parallel, not only with each other, but with the piston-pin hole at the other end of the rod. The tolerance is 0.002 in. in 3 in. Another requirement is that the four bolt holes must be parallel and within a tolerance of 0.001 in. in the distance between the centers.

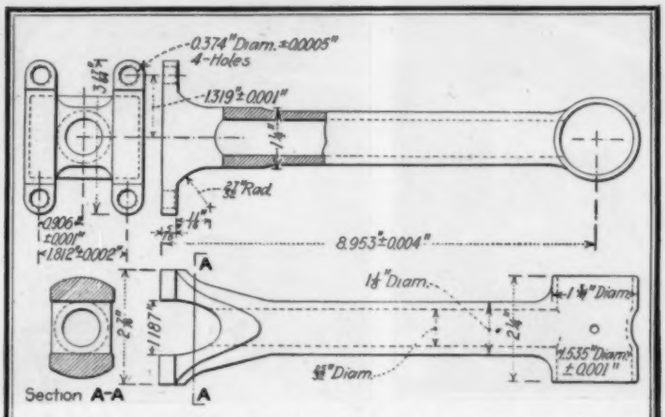


Fig. 10—Details of the inner connecting rod

Outline of Operations

Center	Straddle mill end
Rough turn shank	Circular mill
Grind shank straight	Drill and ream
Drill piston-pin hole	Drill four bolt holes
Finish form turn cone	Grind face and back
Drill ⅞-in. hole	of bolt flanges

Scrape faces of bolt flanges

As will be seen from the outline of operation, much of the work is similar on the two rods and the differences can be noted by comparing the operations in this and the previous article.

After inspecting for hardness, which must equal Brinell 260, the forgings are snagged at both ends to remove the scale. Then both ends are centered for turning in a Lo-Swing lathe, using two tools. After finishing the shank by grinding, the piston-pin hole is drilled, rough bored and reamed. The ends of the piston pin-boss are then faced and hollow milled as with the other rod.

Then comes the rough and finish turning or the cone at the large end of the rod as in Fig. 11, which shows the finishing chips as they roll up over the tool. Two of the rough forming tools are shown on the lathe carriage.

The crank end of the rod is then milled flat and to the proper length, after which the rod goes to the drilling machine shown in Fig. 12, where a ⅞-in. hole is drilled in the large end at right angles to the piston pin hole. A three-fluted, high-speed drill is used, being guided by the substantial bushing and support shown. This view shows the construction of the drilling fixture quite clearly together with the guide for the drill.

Having the hole drilled makes it easy for the milling operation shown in Fig. 13, which cuts out the end of the rod, mills into the hole previously drilled and straddle mills the outside flanges. In this fixture it will be noted that the rods are located by the piston-pin holes and clamped in pairs against suitable jaws. The fixture is very substantial, and the work is done on a No. 2 Cincinnati milling machine.

The fixture, Fig. 14, locates the rod by means of the piston-pin hole and clamps it in the center as shown. This operation removes the surplus stock around the piston-pin hole, the work being done on a Becker vertical milling machine as indicated.

The drilling of the hole in the shank is similar in both types of rods except that in the outer rod, previously described, the hole does not go clear through. With the inner rod the hole is drilled entirely through the shank as can be seen in Fig. 10. The rods are held in a special chuck on a Warner and Swasey turret lathe as shown in Fig. 15. The rod is both positioned and held by the swinging clamp *A* while the drill is guided and supported in the work by the bushing *B*.

The swinging clamp is part of a special chuck which has a very substantial support extending from the face plate. This holds the rod firmly while being drilled and allows it to be easily handled both before and after drilling. The chuck must hold the rod very true as the tolerance on concentricity is very close. The hole goes clear through the rod as can be seen in Fig. 10.

The four bolt holes are drilled in a special fixture that answers for both drilling and reaming after which both

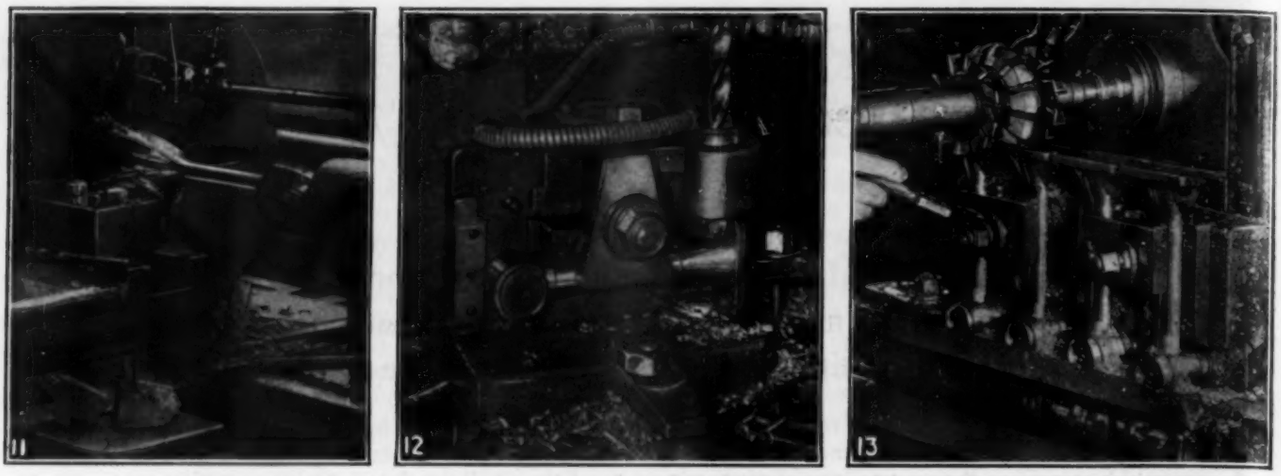


Fig. 11—Forming large end of rod. Fig. 12—Drilling hole to reduce milling operations
Fig. 13—Forming and straddle milling large end

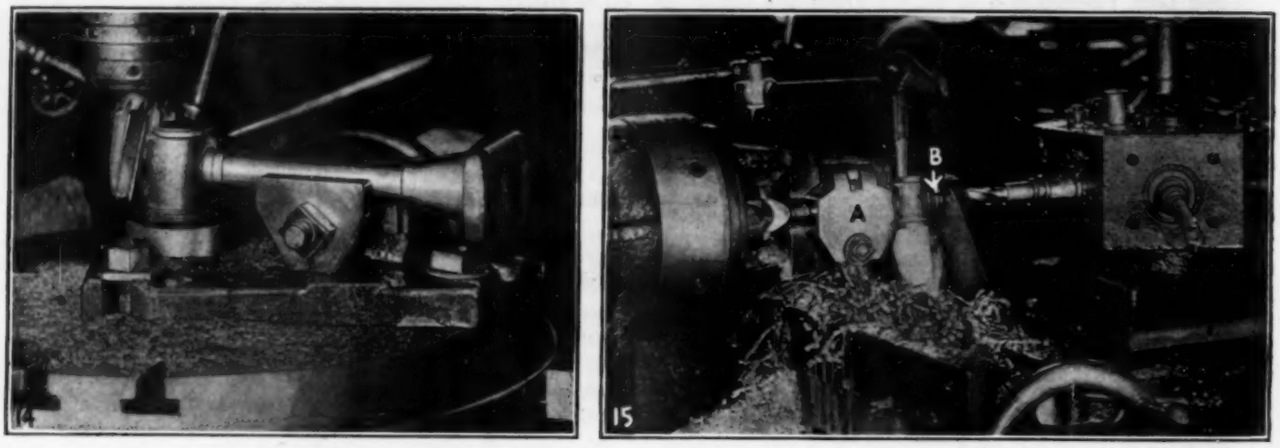


Fig. 14—Removing excess metal from small end. Fig. 15—Drilling and reaming hole through connecting rod

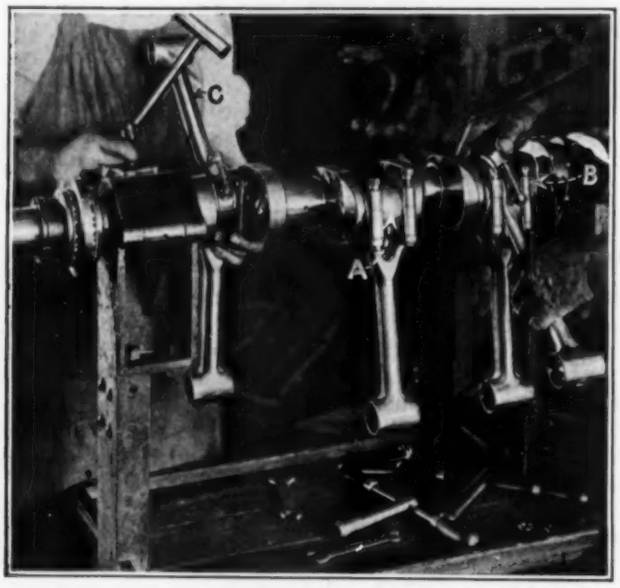


Fig. 16—Assembling rods on crankshaft

the front and back faces of the bolt flanges are finished on a Bath grinder. The tolerance of the distance of 8.953 in. from the center of the piston pin hole to the face of the bolt flange is plus or minus 0.004 in. this dimension being held very accurately.

After the further drilling of minor holes and thoroughly burring at every point, the faces of the bolt flange are scraped to a surface plate in order to secure a firm seat for the bearing which must be properly positioned and square with the piston-pin hole. In some cases a slight relief is ground in the center of the rod so that the bearing may be sure to come on the four corners instead of the center. This relief is only 0.0015 in. and is optional.

The rods are then ready for assembly and Fig. 16 gives a good idea of the way in which they go together. An inner rod is shown in position at *A*, while at *B* an outer rod is just being located on the bearing of the inner rod. At *C* the two rods have been put together and the bolt is just being tapped into place with the small soft hammer shown.

The need for accuracy can be seen from the way in which the rods fit together. The first rod must fit the pin with just the proper allowance or clearance, so as to insure the desired oil film between the pin and bearing. The conditions affecting the second rod, which bears on the outside of the brass of the first rod, are somewhat different. For while the pin revolves in the first rod bearing, the second rod moves through a relatively small angle on the first bearing.

Industrial Cost Accounting for Executives

By Paul M. Atkins

Article twenty-eight—Cost statistics and the two methods of their visualized presentation—The purpose, value and kind of comparative reports — Graphical and ratio charts

IT IS VERY interesting and important to note when considering the services rendered by any kind of accounting that the accounts themselves are often not so arranged that they provide information in such a form as to make it easily understood, especially if the person who is studying the data has not been trained thoroughly in accounting principles and methods. Even though he had been adequately educated along such lines it frequently occurs that the executive finds it much more helpful to have the information presented to him in some other form. In practically all cases, also, this is essential from the viewpoint of the accounting departments, as otherwise books of entry on which they desire to work would be lacking because required by the executives for their use. What applies to accounting records in general applies with particular force to the cost accounts—they need preparation for executive use.

There are two ways in which data which have been recorded in numerical form may be presented to best advantage—one way is the statistical method and the other is the graphical. Both have certain especially helpful points and each is related to the other, for to prepare a graph it is essential first to place the information in statistical form. Both of the methods are discussed in the following paragraphs.

Statistical and Graphical Presentation

These methods permit benefits to be derived from the cost accounts which would not be possible or which would be difficult of attainment so long as the information remained in the account form. Comparisons for example, are made feasible which are of the greatest assistance for control purposes, comparisons which would be buried and useless as long as the figures to be compared remained hidden in books of account. It should not be thought from this that the utility of ledgers and journals has been underestimated or that it would be possible to get along without them. The amount of attention which has been given such matters in the series of which this article is one, should contradict any such misconception. It is quite essential to a complete and integrated set of records that all necessary ledger accounts be kept, and hence it is frequently necessary to set up accounts in which the entries only indirectly affect the figures which interest the executive. In addition, the statistical and graphical methods also permit the presentation of a great deal of information which does not necessarily enter into the composition of the accounts and which comes, it might be said, as a sort of by-product to the accounting processes. Often such information is even more enlightening to the executive than that which comes from the accounts.

The task of an adequately trained cost accountant is not completed until he knows how to prepare the reports which may be called for from time to time by his superior officers and until he so thoroughly understands both the method of presentation and the content presented that he can explain the facts when questioned

RETAINERS PAID

Dept.	Name	October 1922	October 1921	Year to Date 1922	Year to Date 1921

Fig. 62—Statistical report sheet

by the executives. The causes which underlie the facts may be beyond either his ken or his control, but the facts themselves should be thoroughly understood by him. If the executive, who controls the policies of the company in whole or in part, is to obtain the maximum benefit from the reports which the cost accountant prepares he, too, must be familiar with statistical and graphical methods of presenting the facts of the case and be acquainted with the range of data which is available for his use including that which lies outside the books of account. For both groups, then, the contents of this article is important.

One of the most valuable benefits to be obtained from the statistical and graphical presentation of the records of transactions is the possibility of making comparisons, a gain which it is almost impossible to obtain from accounts because of the arrangement of the accounts to meet other needs. In order to be able to measure it is not only necessary to have a unit with which to measure—in this case, the dollar—but it is also essential to have a starting place or point of reference. This is peculiarly true of the business manager. It is not very enlightening to learn that the cost of a certain unit of product is so and so many dollars and cents. This figure alone is not of much, if any, assistance to him in deciding what to do next. It begins to assume significance, however, when he learns that his cost is one dollar higher than the cost for the preceding month, but fifty cents less than that of the month before that, and it assumes even greater meaning when he learns that it is one dollar and a half over what the standard cost for it should be. He now has a point of departure

For the author's forthcoming book. All rights reserved.

and can compare what is with what has been and what ought to be, and with these comparisons in mind he is in a position to make wise decisions. Statistical and graphical reports, if they are to have value over and above that possessed by ordinary accounts and accounting statements must provide for this possibility of comparison.

There is a wide variety of comparisons which can be made and which may be helpful to the executives. Some of these as have been suggested are comparisons of figures for the current period with those for the same kind of subject matter for a previous period, comparisons between actual and standard costs and comparisons of cumulative figures for the year to date with those for the preceding years for the same months. The last kind is of special value in the case of seasonal industries where it often happens that there are marked fluctuations from month to month, and where the changes from year to year indicate the crucial facts for the company to consider. Not all of these comparisons are needed for each record, but the selection should be made according to the kind of problem which must be faced by the executive who is to use them.

The Preparation of Statistics

The preparation of the statistics themselves does not offer any serious difficulty in most cases. The information is ordinarily obtainable directly from the accounts or other records and when this is not possible, simple calculations are usually all that are needed. It is customary to show dates along the top of the sheet on which the statistics are recorded and the items in a vertical column at the left as indicated in Fig. 62. It is not essential that this rule be followed if there is some good reason for departing from it. It is an excellent plan, whatever arrangement is adopted, to follow it for all the statistical tables prepared. It makes it much easier work to prepare and to read them and prevents errors both in preparation and interpretation. It will be impossible always to avoid exceptions, but when it can be done, it should be for the reasons given above.

Statistical records have been employed for a long time and have been used in the business world quite extensively wherever adequate control has been attempted. They serve to make usable much information which would otherwise be buried, but nevertheless, experience has shown that tables of statistics are subject to serious limitations in actual practice. A mass of figures presented in tabular form may contain much helpful information but it is not very easily understood or applied when so arranged. It is very simple to make a mistake and read the figure in an adjoining column or line, and so be completely misled in regard to the facts. When comparisons are to be made it will be found difficult to hold two figures in mind at the same time unless they are side by side, and then it is often not easy to grasp the real significance of the difference which exists.

In order to cope with these and other difficulties the plan of using a graphical means of presenting statistics has been rapidly developed in the last few years. Charts of various kinds are the means customarily employed and it has been found that they are very helpful in the use of statistics. The kind of chart most commonly found is that illustrated in Fig. 63. The time periods are shown by equal spaces in a horizontal direction, and the quantities by equal spaces in a vertical direction. From the plot shown it may be seen that it is very easy to read the figures and that comparisons, both between different times for the same data represented by points on a single transverse line and between different figures for the same date represented by points on the same vertical line may quickly be made.

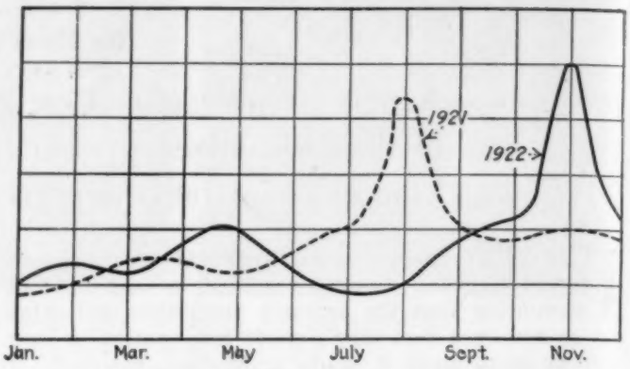


Fig. 63—Simple graphic chart

The actual increases and decreases can be seen at a glance since equal amounts are represented by equal spaces no matter where they may appear on the chart. This type of chart is one of the simplest.

There is one important fault with the kind of graph above described. It shows clearly and directly the actual variation from one time to another, but for that very reason it does not present clearly the percentage fluctuations which sometimes are much more important for control. For example, if an expense for one month is $100 and for the second month is $200, then the absolute increase is $100, and the percentage increase is 100 per cent. If the third month reveals this same class of expense as $300, the absolute increase once more is $100 over the second month, but the percentage increase is now only 50 per cent. A similar absolute increase of $100 the fourth month would give a percentage increase of only 33⅓ per cent. Of course, all the absolute amounts would be shown by the same sized vertical spaces on the chart and in order to obtain a clear conception of the percentage changes it is necessary for the reader to compare the ordinates of the several points plotted and this is rather hard to do. If the comparisons which are desired are between absolute figures, then this kind of chart is unquestionably the one to employ, but if percentage comparisons are desired, then it is much more satisfactory to use what is now called a "ratio" chart.

Ratio Charts

The ratio chart, shown in Fig. 64, has been designed to make possible the ready reading of percentage fluctuations. The vertical lines on the ratio chart are spaced equally to indicate equal lapses of time. The horizontal lines are not spaced equally, but the distance from the base line is increased by the "logarithm" of the number which the line represents, instead of by the number itself. As a result the percentage increase or decrease is represented by the actual vertical distance between any two points. Twice the height of one point above another means that the figure represented by the first point is twice that of the figure represented by the second point, and this holds true no matter where the two points may be. The actual numbers themselves should be shown against the lines so that they may be ascertained from the chart as well as the ratios between

them. Wherever percentage changes are to be considered this kind of chart is the one to use. The cost accountant who prepares one, however, should make sure that the executive who is to use it understands how it is arranged as otherwise the former may find his chart misunderstood and consequently confidence will be lost in the reports which he prepares.

For both kinds of charts it is essential that the information be prepared in tabular form before any attempt is made to enter it on the chart. Data from scattered sources can seldom be entered correctly if it is not first assembled.

It will be found that the value of the charts lies in the possibility of studying several trends and in making comparisons rather than in a careful survey of the details involved. It is not possible to make a graph so accurately as to show the exact values, and hence when detailed information is sought, reference should be made to the tabular statistics.

Selection of Statistical Material

So far, not a little has been said about the presentation of statistics, but nothing has been written about what statistics are to be so prepared. The selection will, of course, depend on a wide variety of circumstances. The first of these is, naturally, the kind of company in question, for information which would be of value for one industry would be useless for another. In the second place, the kind of individual who is to use the data must be considered. Some men think in statistical terms and can reason clearly from figures. Others are not able to visualize the facts in such terms and hence need to have the required information presented to them in some other form. The previous training of the executive must also be considered in

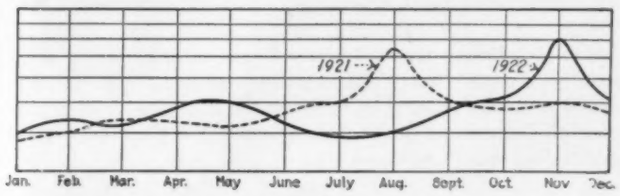


Fig. 64—Ratio chart for reading percentage fluctuations

this connection for the mathematically equipped man is in a much better position to understand the statistical presentation of facts than his brother who lacks this kind of background. The size of the company is still another factor to be considered. The large concern keeps the executives so far from the detailed operations which they are indirectly controlling that much fuller use of reports must be made.

It would be quite impossible to enumerate all the different kinds of information which it is possible to obtain from the cost department, but in the following paragraphs some of the more important statistics to be obtained therefrom are indicated. Perhaps the most interesting of all reports to the general manager in many cases are those in regard to material. The inventories of materials on hand are always of interest, and the comparison, shown by chart, of the figures for stores, worked material, worked material in process, merchandise, and the merchandise in process should always be useful to the manager in guiding the policies of his company. By studying the relations which exist among these several inventories he should be in a position to see whether he is providing properly for the future in the light of orders on hand and probable future demands. With this information he can compare his status with the master schedule, and if necessary, take steps to make adjustments required by the circumstances of the moment.

Expense Report

Expenses are generally the most interesting and valuable of all the statistics which may be presented to the general manager by the cost department. Maintenance in all its forms is one of the items which needs constant watching. It is very easy to slip in the cost of improvements as a maintenance cost and it is even easier to allow the repair and upkeep of the plant to become excessive. It is not so easy to set standards for maintenance costs as it is to establish them for production costs and for this reason they need especially careful watching. The fact that maintenance expenditures do not fluctuate with the volume of business—extensive repairs often being made during the dull season—means that comparisons between the same seasons of different years is often more valuable than between successive months.

It is not at all necessary to present all expenses in statistical or graphic form to the manager. Fixed charges, because of their fixity, do not require any such presentation. If the executive wishes to study the composition of the accounts for this kind of expense, the fixed charges sheet, discussed in an earlier article, will furnish him all the information which he needs. If he so wishes, it may, of course, be graphed at any time.

Other accounts like those for liability insurance often do not interest him particularly. He knows that the liability insurance costs fluctuate substantially in the same ratio as the number of employees and if he is informed in regard to the number or the amount paid in wages he knows all he wants to about the liability insurance premiums.

The Retainer Account

On the other hand there are detailed accounts which the manager in most cases will want to watch most carefully. An illustration of such an account is that for "retainers," the amount paid workers to keep them at the factory ready for work when there is nothing for them to do at the moment. The payment of such retainers is almost invariably a sign that all has not been carried out as planned, or else that there was a failure to think ahead into the future in an adequate fashion. It is usually impossible to avoid altogether the payment of retainers, and an entire absence of charges of that kind is usually an indication that the cost is being concealed in some other account. Any considerable amount, however, deserves investigation, and hence the manager should insist upon being informed each month of the amount of this cost in each department It is usually wise for the cost accountant to ascertain the reason for any large charges thereto before he turns in the report to the executive, and to attach the findings to the report as they are sure to be called for when the figures are seen.

The reclamation of errors account falls into the same class as the retainers. Carefully made charts should be kept of such expenditures and thorough investigations made of all excessive amounts. Accounts like these are important means of feeling the pulse of the business in so far as the internal manufacturing opera-

tions are concerned, and as aids to the control of the business they are more valuable to the executive than the amount recorded therein would seem to indicate.

The wages and salaries accounts and the supplies accounts of the several manufacturing departments are other accounts which should be reported in statistical form under most conditions, and the miscellaneous expense account is another that practically always requires consideration.

For many of the office departments it is sufficient to report the total departmental expense without giving any analysis by accounts. The cost of operation of many of these departments is far less subject to fluctuation than is the case of factory departments. If any marked changes in the totals are noted, it is then time to investigate the details.

Burden is another item which should keenly interest any intelligent executive. There are a number of comparisons that can be made which should be extremely helpful, namely, the amount of the earned burden with the total burden, the amount of the total burden and the standard burden, the amount of the earned burden and the standard burden. These are statistics which will enable him to study the efficiency of the factory operation and will lead to a more intelligent understanding of what has been going on therein.

All the above described information can be obtained directly from the cost records. There are additional data which do not form a part of the cost departments routine work which are often very valuable. It is important, for example, to know the amount of the unearned burden, both as a whole and by departments. In seeking a remedy it is desirable to know also the cost by production centers. The records of idle machine time which should be maintained by the planning department can be translated into terms of dollars and cents by the cost department and supplement in an effective fashion, the statistical form of the regular accounts.

Space will not permit a more lengthy discussion of this very important subject here. It is hoped, however, that enough has been said to indicate the importance of an adequate arrangement of the statistical data for use by the executives, to present some of the many methods employed to accomplish such results, and to suggest some of the kinds of information which usually prove serviceable. Each cost accountant and executive should give this problem proper consideration and apply the general principles and methods of statistical records in the light of the particular circumstances of his own concern, choosing those which prove most adaptable and useful.

What Is Your Advice Worth?

By L. N. Miller

The other day a man came into our office accompanied by his son, a young man of about sixteen years. He stated that he was a Mr. Hendricks and that he wanted to talk with the head of the firm. After a few introductory remarks, he informed us that he and some associates were forming a company to manufacture a transmission for automobiles, and he requested us to look over a bundle of blueprints he had brought with him, numbering about fifty, and give him an estimate of what machinery would be required, together with a time study for each piece, the cost of each machine and the tooling necessary to go with it.

We called in our chief engineer who, after looking over the prints in a preliminary way, told Mr. Hendricks that it would require two or three days time to go into the matter in detail and that we would then send him a quotation.

Following this discussion, we had a rather pleasant visit with Mr. Hendricks, during which he stated that he had an appointment with the law firm of Smith, Wilson & Jones, as they were to incorporate his company. He also mentioned that his boy had not been feeling well, and he inquired of us the name of a good family physician. As he was not familiar with the city, he readily accepted our offer to send one of the junior salesmen with him to conduct him to the office of the lawyer and doctor.

He mentioned that he had driven into town in his touring car, had had a slight accident, and the machine was in the garage being repaired.

Our salesman took them to the office of the law firm and waited for him while he transacted his business.

Our salesman then took Mr. Hendricks and his son over to the office of the physician, and after waiting some time was admitted to his private office. The doctor looked the young man over, and wrote a prescription to be filled at the corner drug store. Mr. Hendricks said he was leaving town and would like to know what the bill was. The doctor told him $4 for the interview.

Our salesman invited Mr. Hendricks and his son to have luncheon with him. That finished, the three of them went to the garage to get the touring car, and Mr. Hendricks paid a bill of $23.47 for material and labor.

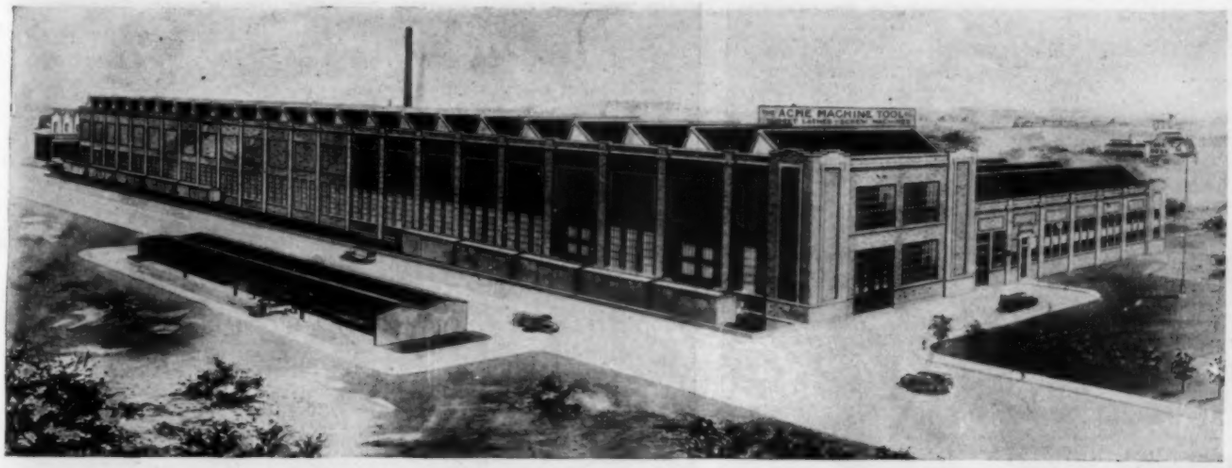
Mr. Hendricks then expressed himself as having been greatly pleased with the courtesy shown him by ourselves and our salesman, and stated that he would give careful consideration to the proposition that we would submit on our machines.

Not So Courteous

We waited two weeks after submitting our estimates, during which time we wrote him two or three letters and received no answer. Our salesman, therefore, went to the city where his firm was located, and called upon him. He was cordially received by Mr. Hendricks, but was told that he and his associates had decided not to go any further with the proposition of the transmission. In front of him on his desk was a bill from the law firm for $250 for preparing the legal papers.

Our salesman suggested that we had spent nearly three days time going over his drawings and had used two of our highest priced engineers on the proposition, in order to get the estimate out promptly. He suggested to Mr. Hendricks that it seemed fair to reimburse us for the expense we had been put to. At this Mr. Hendricks became highly indignant and said that if we were so small as to expect to be paid for our advice, he would certainly never call upon us in the future.

Question: If it is all right to pay the lawyer, the doctor and the garage man for advice, what is there peculiar about the engineering advice that the machine tool builder gives, that it should be furnished for nothing?

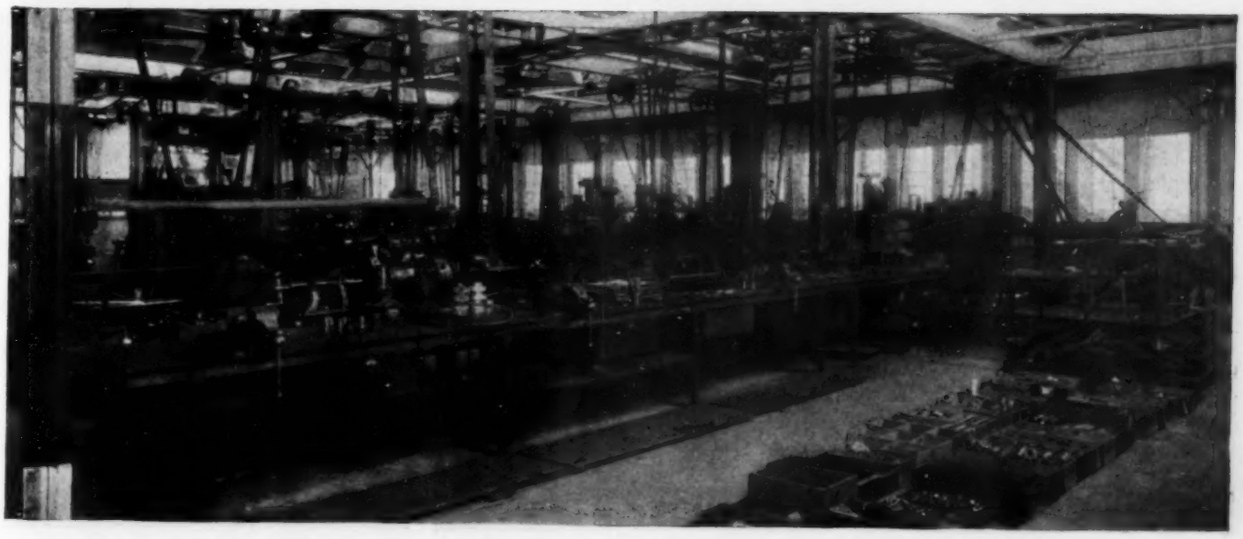


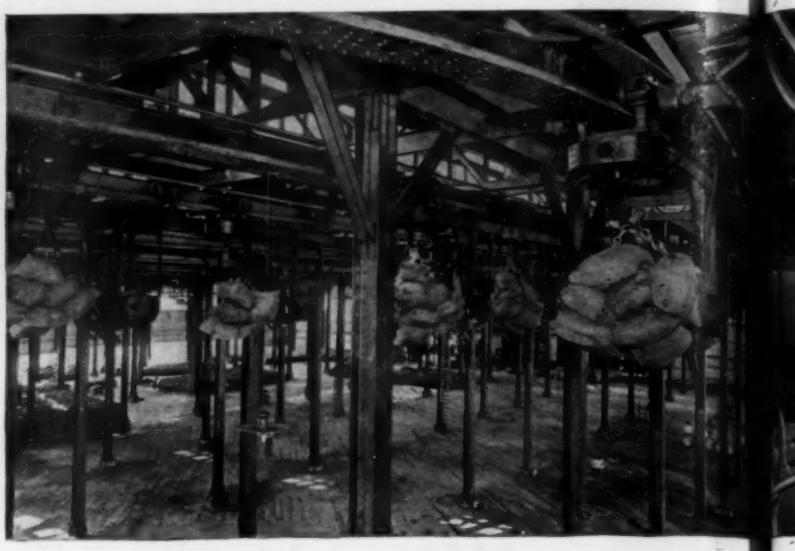
Where Machine Tools Are Made

Acme Machine Tool Company

Cincinnati, Ohio

Founded 1908





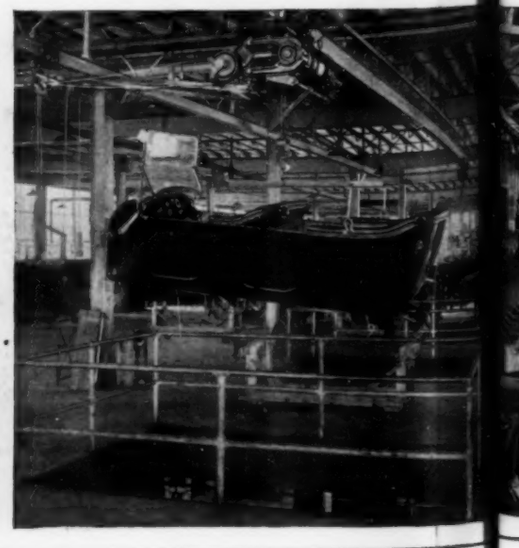
Modern Conveyor Systems

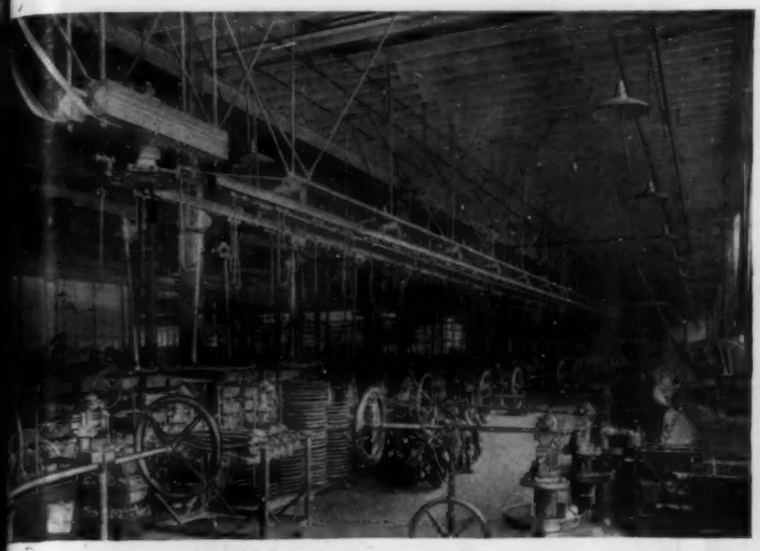
Photographs by courtesy of

Link-Belt Company

YEARS and years ago, a farmer taking some grain to the mill to be ground, put all the grain in one end of a purse sack, and an equal weight of stones in the other end, to balance it on his horse's back.

A bystander asked him why he did not throw out the stones and put half the grain in one end

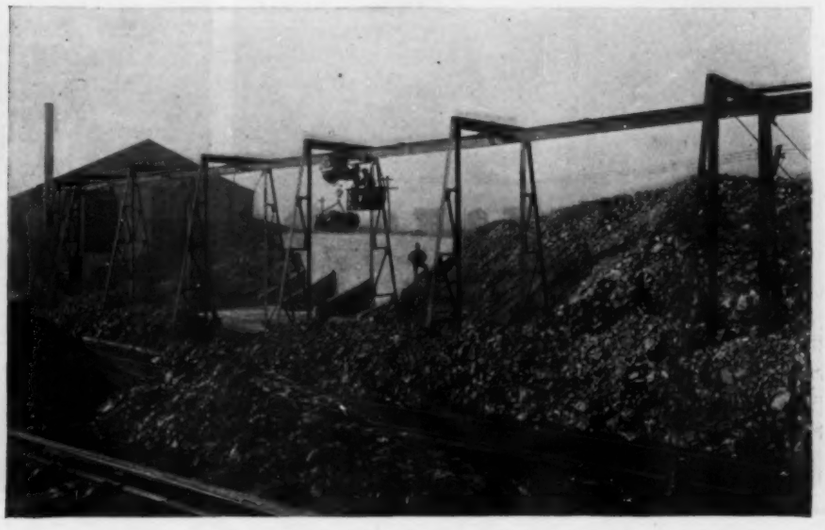


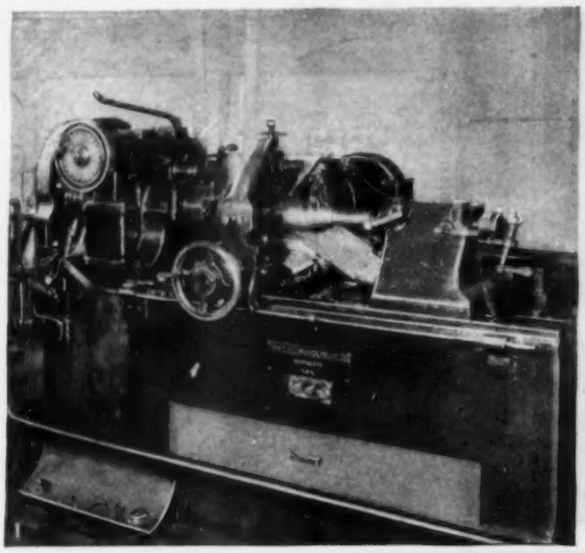


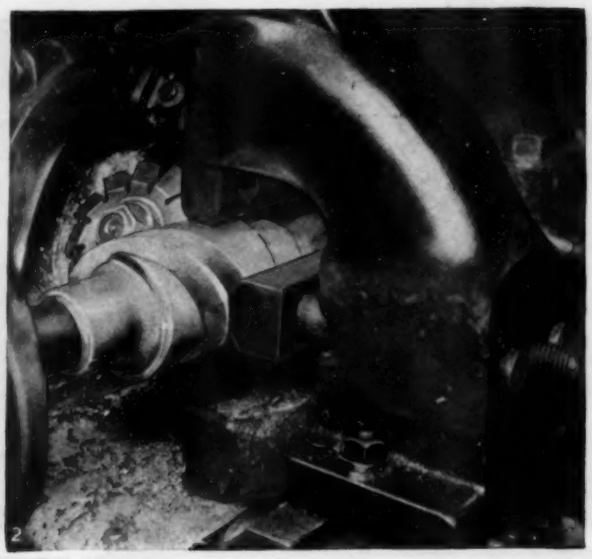
of the sack and half in the other end, and thus relieve the horse of one half the weight.

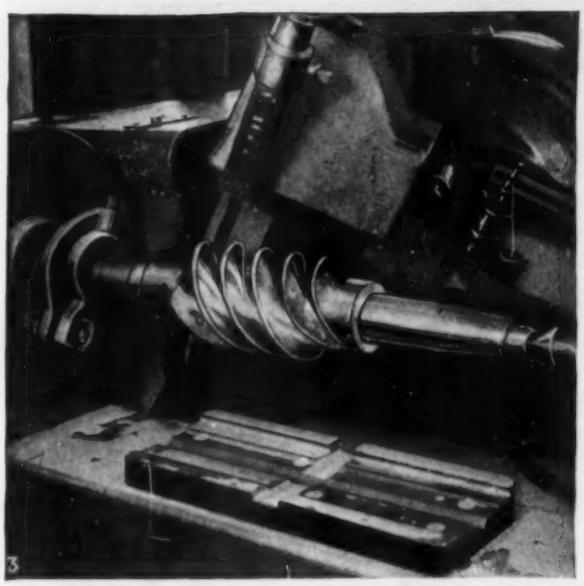
The farmer replied: "My Grandfather did it this way and his way is good enough for me."

If we had kept on doing things "Grandfather's" way, we would never have had such modern conveying equipment as is shown in these pictures.









Making Worms for Sheldon Axles

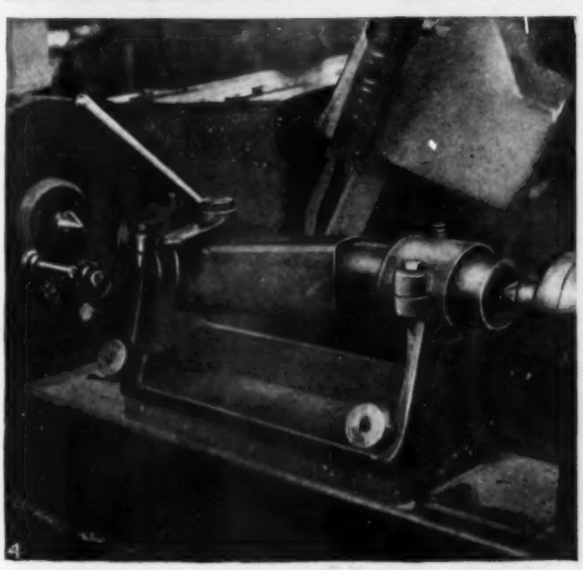
Fig. 1—Cutting worm on Lees-Bradner machine

Fig. 2—Close up view showing cutter at work. Method of swinging cutter for various lead angles and how worm is supported against thrust of cutter

Fig. 3—Grinding thread of hardened worm

Fig. 4—Fixture for dressing wheel to proper angle

Fig. 5—Testing worm with worm wheel. Indicator shows high spots as worm is turned



What Becomes of the Chips?

By C. J. Priebe

The chip house at the LeBlond plant—How the chips are handled on a production basis to facilitate shipment—Plant for separating and filtering oil

ALTHOUGH the production of chips is one of the chief concerns of the management of a machine shop, their disposal is ordinarily given but little attention. A visitor to a machining plant sees plenty of chips being made, but he usually is not shown what becomes of them. Naturally, since the chips are a by-product, and a rather undesirable one at that, the management is interested merely in getting them out of the way as quickly as possible. Large and progressive firms have in many cases built up systems and plants for handling their chips on what might be termed a production basis, just as they do the work that they manufacture.

At the plant of the R. K. LeBlond Machine Tool Co., in Cincinnati, there is a chip handling plant that is quite up to date, and unique in some of its features. It was added shortly after the main plant was built, and was not a part of the original installation. The functions of the plant are to remove the oil from the chips, to provide a storage space for each class of scrap and to facilitate shipment of the material.

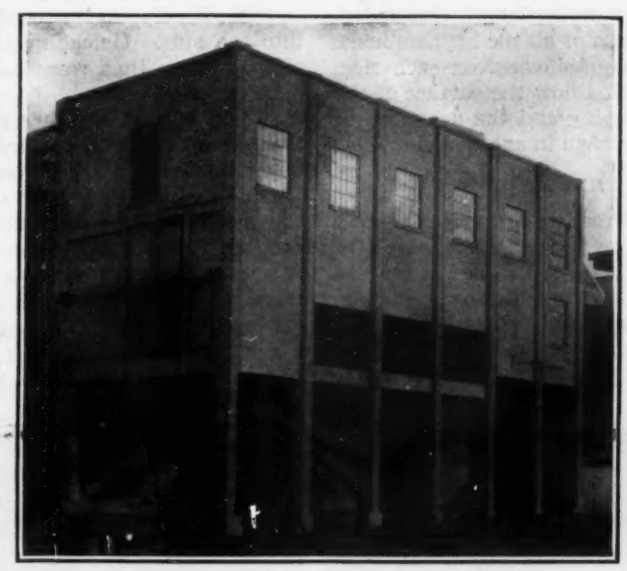


Fig. 1—A general view of LeBlond's chip house

The chip plant is located on the west side of the main building, and appears as shown in Fig. 1. It will be noted that the structure is built over a railroad siding, and directly against the main building. It is 24 ft. wide, 60 ft. long and some 40 ft. high above the ground level.

Reinforced concrete is employed throughout, even for the flat roof, which slopes toward the main building, where proper drainage facilities are provided. By the use of metal sash and fittings, the structure is made entirely fireproof. The columns shown are spaced at 10-ft. centers. The ground at this point varies from 4½ to 5½ ft. below the level of the floor of the main shop.

The illustration shows the location of the different parts of the chip plant. The iron balcony where the operator stands when manipulating the gates of the hoppers can be seen, while at the level above that is the room in which the oil filtering apparatus is placed and where the hoppers themselves are located, with room underneath for a gondola railroad car. The top level, where all the windows are observable, is the one at which the chips are brought to the hoppers; it is 21½ ft. above the floor of the shop. Toward the right the location of the elevator can be noted by the position of its pent house and foundation.

Since the chip plant is built against the main building, entrance to it is obtained directly from the floor of the machine shop, and without going out-of-doors. A 5x8 ft. doorway equipped with a heavy sliding door as well as with a safety gate, gives access to the elevator, which is 5x7 ft. in size, of the Warner electric type, and has a capacity of 5 tons. Another doorway next to the elevator door gives entrance to a stairway by which the chip house may also be reached.

The trucks containing scrap or the buggies filled with chips are run on the elevator, which is then brought to the top or charging floor. A good idea of this second floor is given in Fig. 2. At the rear can be seen the elevator shaft, while on the 8-ft. runway down the center of the room will be noted one of the chip-carrying buggies built especially for the work. The ease with which this buggy can be dumped into the bins, as well as transported about the shop, are its particular features.

Cast-iron chips can be dumped directly into the hoppers. Steel chips, however, that were cut with the aid of a cutting oil are dumped into the Tolhurst separator set in the floor at the far end of the room. After being whirled for some time, the chips, still in the drum or barrel in which they were held in the separator, are lifted by the 3-ton Sprague crane in the manner shown. Since the crane is mounted on a beam and travels the length of the room, the chips can then be brought to any hopper desired. The oil goes to the oil room below the separator, and its treatment will be spoken of later.

There are seven hoppers, each of which contains a different kind of material or grade of chip, as indicated by the signs on the wall. The hoppers are spaced at 5-ft. centers, and extend the full width of the room, so

Fig. 2—Main runway on the charging floor. *Fig. 3—Another view on the second floor*

that their inside length is about 22½ ft. The openings at each side of the runway serve the same hoppers, as there is no vertical partition running lengthwise underneath the runway. The bottoms of all the hoppers make a 90 deg. angle, with a slope of 45 deg. on each side. The total depth is nearly 15 ft. below the surface of the runway. The method of dumping and the use made of the slanting bottoms will be shown in another view.

Looking Down the Runway

If we look in the other direction down the runway on the main charging floor, we get a closer view of the oil separator, as at the left in Fig. 3. At the far end of the room are two bins having flat floors and arranged for holding scrap material. These bins are about 8 ft. wide, and are arranged side by side; the length of one is 9 ft. and of the other 11 ft. A heavy wooden lining is placed on the floors and walls of the bins, so that the scrap parts can be dumped or thrown in without chipping the concrete. Iron ladders go down into the bins. Unloading is done through the vertical sliding doors that were seen on the end of the chip house in Fig. 1.

It will be noticed there that the two doors are controlled separately from the ground. The handwheel operates through worm gearing and then through pinions and racks on the doors. This arrangement makes the mechanism irreversible, so that the doors cannot drop when unloading is going on. The doorways are 3 ft. wide and 6 ft. high, and the doors themselves are made of ⅜-in. steel plate and held in place by steel guideways. When loading the cars, the attendant throws or pushes the scrap out through the door.

Following the path of the oil that was extracted

Fig. 4—View in the oil filtering room. *Fig. 5—Bottom of the hoppers, showing how the chips can be dumped into railroad cars*

from the chip masses in the separator, we come to the oil room. A view in this room can be seen in Fig. 4, with the bottom of the chip separator observable at the upper right. It will be noticed that the motor on the floor is belted to the separator. The extracted oil is piped to the oil filters and tanks shown at the left. This cutting oil can then be used over again, and new oil is added to make up for losses. In addition, an antiseptic is put into the oil for the prevention of skin diseases that the operators of machine tools sometimes contract from cutting oils.

The oil is transferred from the filter tanks to portable tanks holding about 60 gal. Since the elevator serves the filter room also, the tanks can easily be brought to the machine shop level. Here they are wheeled to the various machines using oil, each of which is equipped with its own tank and pump.

The chip house will hold a little over a carload of each kind of metal cut, and as soon as a carload of any kind has been accumulated it is shipped out. With the plant running at full capacity a carload might be accumulated in a month, although usually a much longer time is required. A railway car is spotted beneath the hoppers on the track shown in Fig. 5 and the chips are dumped into it.

The construction of the hopper bottoms, which we have already mentioned, shows very well in this illustration. The whole bottom of each hopper can be opened, as the steel plate doors extend the full width of it and meet at the bottom. Thus, when both doors on the sides of a hopper are opened, the bottom presents an opening about 5 ft. square, which should make tangled and solid masses of chips easily removable. The hopper doors are ½-in. steel plate, and are mounted in steel slides, so that they can be slid upward and out of the way.

Each door is independently controlled by means of an 18-in. handwheel, a row of which can be observed on each side of the illustration. The handwheel operates through worm gearing a pinion shaft that meshes with a rack on each side of each door. The arrangement thus prevents cramping of the doors in the guides, and should enable them to be easily moved. Here again the irreversibility of the mechanism is valuable, as the doors cannot slip down of themselves after they have been opened.

The two hanging iron balconies on which the operator stands when manipulating the gates can be observed. They give the operator a position where he may easily watch the movement of the chips, and yet not be in danger of being struck by them.

Our inspection has just told us what becomes of the chips at the plant. What becomes of them after they are placed in the railroad cars is largely a matter of conjecture, as they are sold either to dealers in scrap material or directly to foundries and steel mills which have need for them and means of consuming them after they have been compressed.

Machine Tools and Labor Saving

By F. P. Terry
Belfast, Ireland

A FEW days ago, when sitting in the office of a prominent works manager, I was somewhat surprised at his views on machine tools. "You know, Terry," he said, "I have read the *American Machinist* just about as long as you have, and we didn't start yesterday. For more years than I care to remember I have carefully studied its pages; I've bought many machine tools, and copied jigs and fixtures galore, which have appeared therein. All of which have assisted me considerably in keeping up with the band, and that battery of automatics you see over there only arrived just in time, as I had hardly got them started when the directors were looking for a micrometer every time they had to spend a sixpence. But I concluded a good while ago that there are no such things as "labor saving" machine tools, or anything else about a machine shop department, and anyone who thinks differently, whether he makes or uses machine tools, is suffering from a delusion."

Of course I differed from my friend's views, but the more we discussed matters, the more convinced I became that there was a good deal of truth in what he said, and that the only labor saving machine tools are the relics of a bygone generation that long ago should have been pensioned. When my friend took his present position, his firm did not employ one hundred hands throughout the works, which had increased to seven hundred and fifty in 1914, and about twice as many clerks were employed as there were machinists in the old days. Every added machine tool reduced costs, but it increased the labor force. Very often one new machine tool paved the way for one, two or three more of the same breed, but it never reduced labor. The progression was continuous, always with added employees.

The above were only a few of his arguments; more could be given, but could not similar ones be given of every firm who adopts modern methods? Personally, looking back for the past thirty years, I cannot recall any firm that has reduced labor or even stood still, and has, as my friend remarked, "Kept in the band." These firms are, no doubt, producing labor saving specialties for use elsewhere. Even my friend produces a conveyor plant that actually replaces about twelve men, which he declares he would not be producing at all without modern machine tools and their cost reducing qualities, but the machine tools themselves provide more and more labor.

We have recently read in these columns, some very interesting and instructive contributions, under the title of "It Pays to Replace." These articles have been most interesting to machine shop men; costs have been reduced in many ways. I mentioned them to my friend. "Yes," he said, "I've read them all, and intend adopting one process, but mark my words, there's not one of them that has a fitting and erecting shop tacked onto its little corner that employs less labor, or pays less wages than before. It would be contrary to nature."

If my friend is correct, and I think he is, would it not be better to drop the labor saving idea from all machine tools, using the more accurate phrase "Cost reducing?" Or better still, have we a manufacturer who will come boldly out and tell us in his advertisements that his products "Increase labor," backed up with a testimonial something like this: "Twenty years ago we installed our first Blank turret lathe. We then employed fifty hands, today we have fifty of these lathes and one thousand hands!" In my opinion a thousand such instances as this would be forthcoming to one of the reverse kind.

Is Beauty a Factor in Machine Design?—Discussion

By James Vose
Lancashire, England

THE query put on page 461, Vol. 59 of the *American Machinist*, "Is Beauty an Important Factor in Machine Design?" to me appears to admit only of an affirmative reply.

Since the great war and at the ensuing auction sales of machine tools which had usefully and profitably been employed on munition manufacture, many tools of almost incredible age emerged and were to be found included in the auctioneer's catalogs. Such tools as those built by Joseph Whitworth and others of the old Manchester school inspired instant respect even to present-day eyes by virtue of their dignified lines and contours indicating strength as and where required without either niggardliness or crude waste in the employment of metal. If the old tools favorably impress present-day eyes it may be surmised that contemporary users were favorably influenced by their beauty and thus gave the concerns who built them a firm commercial standing which for many years went almost unchallenged. Apropos of the remark of the artist-machinist whose approbation of what he considers the beautiful lines of English locomotive and ship building is mentioned in the article, it may be noted that their manufacture and that of machine tools were closely associated. Even now certain celebrated British locomotive builders construct many tools both for their own and outsiders' use.

Closely allied to the matter of beauty of design is the question of suitable finish. Stinginess in giving a modicum of polish to portions of machinery which seem to ask for it will militate against sales. The cost of legitimate finish, if studied and provided for with the same care as usually is accorded the machining and assembling schedules need not be really alarming. Several British toolworkers make a feature of high-class painting and polish detail work on their machine tools with satisfactory commercial results. A special function of an internationally experienced director of one large tool works is to satisfy himself that the outlines and contours of his products comply with the demands of his practically cultured taste.

Sharp Tools Produce Good Finish

Irrespective of polish produced by abrasive agents, very pleasing effects are obtained by paying special attention to the invariable use of extra sharp cutting tools. Along with it may be the virtual elimination of vibration and the use of selected cutting lubricants or coolants. Even the direction of feed marks on finished surfaces may be conducive or otherwise to a satisfying general effect. My own preference as regards tool marks is that they should run in the longitudinal direction of the piece. Some makes of American gunmetal or brass valves while quite satisfactory in every respect as concerns price, efficiency and general first appearance have on closer inspection tended to repel me through the milling of the flats of the hexagon or other rectilinear portions having been executed with obviously dull milling or "fly" cutters. In other examples the flats having been ground on rough abrasive wheels or disks has detracted seriously from the appearance of the work. Or they have subsequently been buffed and have the final appearance of, in the old English shop phrase, being "highly polished and deeply scratched," thus adding to the original offence. As an instance of the opposite effect I have handled plain brass hexagonal nuts which were a real pleasure to see, owing to the flats being machined by means of honed edge fly cutters. The ends of the nuts being chamfered with honed lathe tools handled to give a slicing cut gave a mirror like finish straight from the tool, the corners of the hexagons being clean and sharp, the thread of the nuts having a clean bright appearance and the bore being slightly bell mouthed at each end to avoid cut fingers when handling or assembling the nuts. Though of such exceptionally good finish the whole of the polish was due to sharp tools and careful manipulation, the cost of production being no higher than would have been the case for second or third class finish. Further, the operators found greater pleasure in their work.

The Human Equation in Making Gears—Discussion

By Lee Morgan

On page 737, Vol. 59 of the *American Machinist*, you have an article, founded upon the report of the Chairman of the Committee on Industrial Relations to the American Gear Manufacturers Association, in which you discuss the "Human Equation in Making Gears." As I am deeply interested I hope that a few considerations from one who works at the bench will not be inopportune.

The report states that "any man who is at all a student of economics knows the hardships and inefficiencies brought about when a shop is thoroughly unionized." Any one who is at all a student of economics knows the hardships and injustices that the men suffer when there is no union. This requires no proof. The patent fact is apparent in that the workers will suffer so much and make such sacrifices to maintain their union.

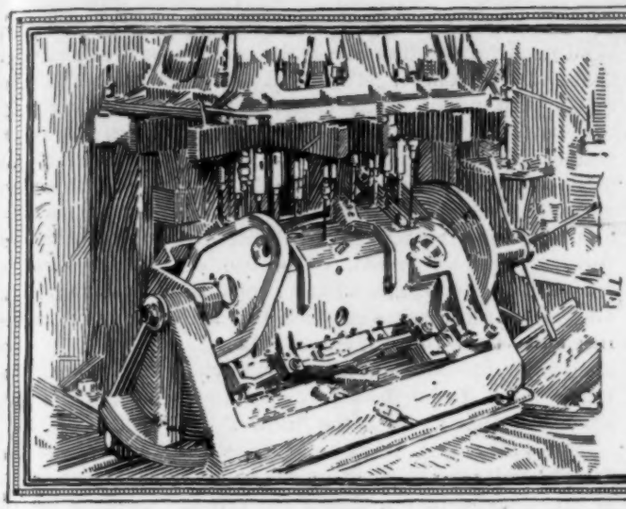
The labor turnover is also discussed. "Labor turnover?" The present writer works at the bench and believes he is some mechanic (with apologies) founded upon years of experience. Where are the good mechanics? They are gone. Many of them have embarked in little businesses, some have gone into other trades—plasterers, bricklayers and other employments, salesmen, peddlers, etc. Why? Because they can easily learn other trades and get more pay. A bricklayer does not have to work vernier and micrometer to the ten thousandth of an inch—and the reward is greater.

Men, green and ignorant, come into the shop and are put to work doing some operation which can be learned quickly and at piece rates can earn much better pay than the most skilled mechanic. These "handy men" can not fix or adjust their own machines when belts are too loose or parts are out of gear. They are impatient and impudent to real mechanics who have to come and adjust the trouble.

I do not envy them wages—but why should not I, and men like me, get as much wages as these green men?

The results are plain. The good mechanics drift to other and less arduous work where the strain is less and the pay is greater.

[We may not agree that unionism is the best cure but at least we must admit that a serious situation is clearly stated here.—Ed.]



Tool Engineering

By
Albert A. Dowd
and
Frank W. Curtis

Pattern work and its relation to the designer—Importance of shape of the pattern—Methods of molding—Construction of flanged patterns

WHEN designing jigs and fixtures, the tool engineer is obliged frequently to make use of various kinds of castings. The majority of these are quite simple in their nature, but occasionally odd-shaped castings are required on account of the nature of the work or for some other reason. Patterns must be made for all these castings, and for this reason it is essential that the tool engineer should understand at least the principles of molding and the use of patterns.

We feel safe in assuming that the average tool designer understands, roughly, how a casting is made, but a few words on the subject may be of general interest. The simplest form of pattern used in molding may be exactly the same as to size and shape as the casting which is made from it. In more complicated work, however, the pattern may be found quite different in general appearance from the casting which is eventually developed from it. The number of holes in the work, the general shape, the various ribs or bosses all have an effect upon the shape of the pattern, as we shall show by means of simple illustrations.

In defining a pattern, we may designate it as a form which can be laid or pressed into damp sand or some other plastic medium, and which upon being removed therefrom will leave an impression of such shape that when molten metal is poured into the sand, the desired contour will be reproduced on the casting. The outside of a pattern is usually of much the same shape as the piece which is to be molded, except that here and there round or square projections may indicate the positions of cores which are afterwards to be set in the mold. These projections are generally painted a different color from the body of the pattern in order to show the molder that they are placed there in order to locate the cores. Projections like this are called "core print."

Jig and fixture patterns are almost invariably made of wood, but they may also be made of rubber, plaster, metal or other suitable material. It very seldom happens, however, that anything beside wood is used in jig work because only a very few castings are required, so that a cheap wood pattern answers every purpose. In other kinds of work where a great number of pieces are to be cast from a single pattern, metal is more frequently used on account of its durability and the uniform results which are obtained by its use. In small work a number of metal patterns of uniform size and shape are frequently made up and attached to a central bar, usually called a "gate." When this gated pattern is laid in the mold and rammed up, the molders' time is much lessened and greater uniformity of castings is obtained.

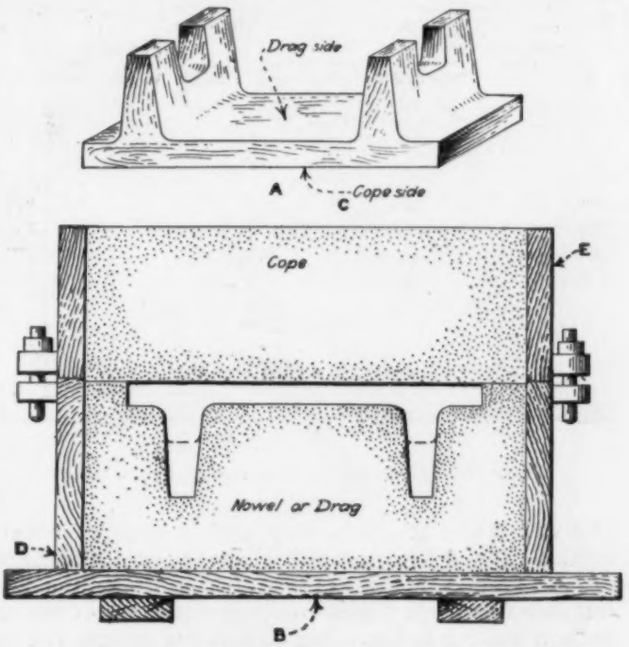


Fig. 577—Simple pattern and method of molding in flask

Metal patterns and those made from wood are made up in the same general way, except that the tools used in cutting the metal are naturally different from those used for woodworking. When metal patterns are used, it is generally necessary to make up wooden patterns first in order to obtain a metal casting, which is later smoothed up and finished to the sizes required.

The tool engineer must consider carefully the shape

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of the jig or fixture when designing it, in order to avoid complications in pattern making. The first thing which a pattern maker must determine is the way in which his pattern will be molded by the foundryman. The point of importance here is the manner of laying the pattern in the damp sand and withdrawing it therefrom in such a way as not to disturb the sand which has been rammed around it. With patterns of a simple nature, the tool engineer does not need to give the matter much thought, but in large and complicated fixture patterns, a great deal of time and money will be saved by giving considerable attention to this matter when designing.

If a great many lugs or bosses project from the pattern in various directions, considerable care must be taken to see that it is possible to make a pattern for the fixture, avoiding the use of core boxes as far as

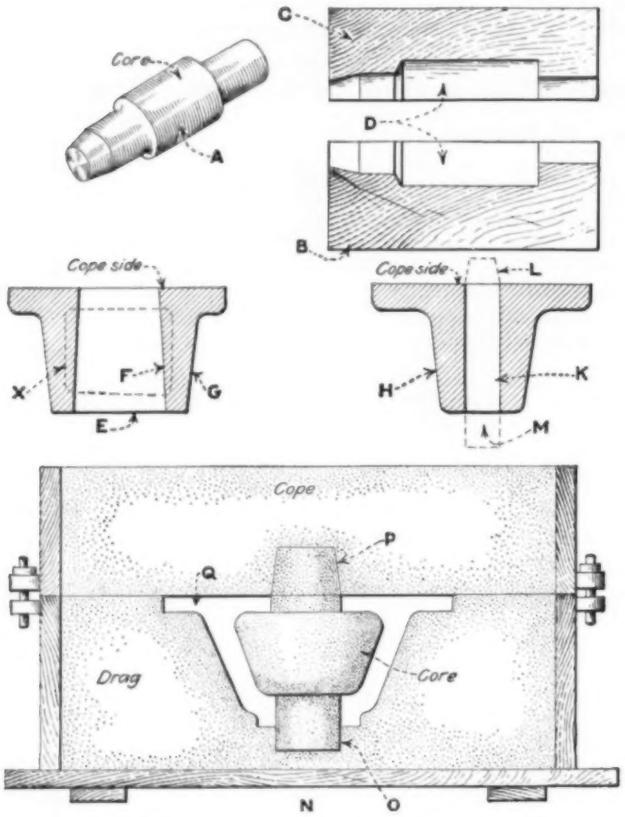


Fig. 578—Core boxes and method of using

possible. The matter of cost is an important one when making jig and fixture patterns, as only one or two are usually required; and, therefore, it behooves the tool designer to become familiar enough with the process of pattern making and molding so that his designs can be cheaply made and easily molded.

If the tool engineer is perfectly familiar with the fundamental principles underlying the science of molding, he will have very little trouble in making his designs so that they will be both cheap and practical. Perhaps the best way to gain an understanding of the subject is to illustrate the important points by means of simple examples and diagrams. Let us consider a very simple pattern such as that shown at *A* in Fig. 577. If we take an example of this sort and follow through the process used by the molder in making the mold, we will have a very good understanding of the method used and the process employed.

In the first place, you must remember that the fine sand used for making the mold is dampened slightly so that it will hold together and keep its shape in the flasks into which it is rammed and pounded around the pattern. The flasks used for molding, in their simplest form, are boxes open at the top and bottom and made of wood or metal. The boxes have lugs on the sides in order to permit the use of dowel pins for accurate registry when two flasks are put together to form a complete mold. The use of dowels permits the flasks to be separated and replaced, so that they will always bear the same relation to each other, thus making sure that the various parts of the mold in the sand will fit each other accurately. In molding, the upper part of the flask is called the "cope" while the lower portion is called the "nowel" or "drag."

The pattern *A* is usually called a "one piece" or "solid" pattern, as it has no core or loose pieces in it. It may be considered that a pattern of this kind leaves its own core in the sand, and is of very simple construction. Furthermore, it is an exact model of the casting which will be produced from it, except that an allowance is always made to provide for the shrinkage of the metal. In this pattern it can be seen that the shape is such as to permit its withdrawal from the sand without disturbance, as the angles of the work allow sufficient draft.

Molding From a One-Piece Pattern

Let us follow out the method used by the molder in making up the molds from this pattern. He first takes a large flat board such as that shown at *B*, places this board on his workbench, and on the board he lays the pattern *A* with the side *C* down. Around the pattern he places the "drag" portion of the flask *D*. The next step is to "riddle" or sift fine sand all over the pattern, ramming it tightly until the flask is full up to the top of the pattern. The remainder of the flask he fills with coarse sand and rams it also to pack it well together.

The molder then turns the flask completely over until the "cope" side is upward, as shown in the illustration. Parting sand (usually white beach or river sand) is now sifted lightly over the surface, in order to prevent the cope side of the flask from sticking to the drag. The flask *E* is now placed in position and the entire box filled with coarse sand well rammed in. The two halves of the flask are then separated and the pattern carefully removed, after which the two sides are put together once more and the flask is ready for molding. The molder, of course, provides a suitable channel and a hole or holes into which the molten metal can be poured so as to lead it to the proper places.

In the example just shown the pattern is of such a shape that it makes its own core, but as this is frequently not possible, the use of cores is occasionally required. The pattern cannot always be placed in the mold and removed from it, so that undercut portions, projections, or holes can be obtained where desired. In such cases a core is necessary, or else the projections must be made in the form of loose pieces which can be readily removed from the body of the pattern and taken out of the sand separately. We will show a few examples of loose pieces in the next article.

When a certain casting is to be made with a hole in it, which for one reason or another cannot be placed in the pattern, so that the latter can be removed from the sand without disturbing the portion that makes the hole, it is necessary to make what is called a "core."

The best way to explain the use of a core is by means of illustration. Referring to Fig. 578, the example *E* shows a flanged casting which has a hole *F* in it made slightly tapering, and an outside portion *G* also tapered to permit ready removal from the sand. Now, as this

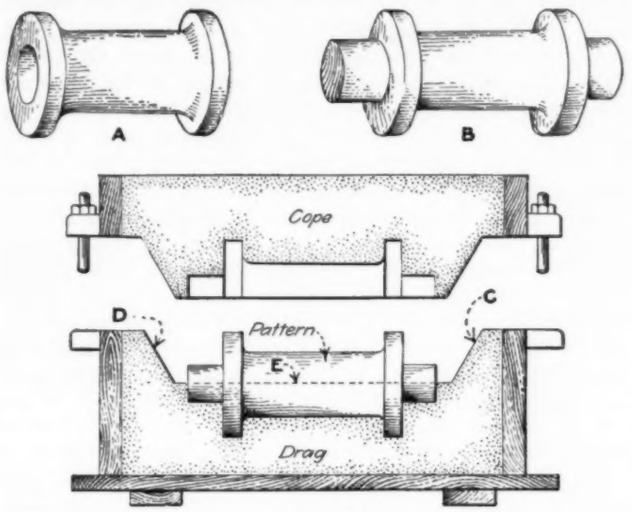


Fig. 579—One method of molding a flanged pattern

particular piece has a large hole in it, it can be molded so that no core is necessary for the hole.

If the same kind of a casting were required with the hole relieved, as shown by the dotted lines at *X*, the work could not be molded in the same manner, as it would be impossible to remove the pattern from the sand without disturbing that sand which fills the recess mentioned. The shoulders of the recess would prevent the pattern from being drawn out of the mold. For work of this kind, therefore, it would be necessary to make a core.

Manufacture and Use of Cores

Cores are made from "green" sand, dry sand or metal, but the most common sort are those made from dry sand. The dry-sand core is molded in a core box made to the shape required. An example of a simple core is given at *A*, and the core box in which it is made is shown in section at *B* and *C*. The two halves of the box are located in relation to each other by dowel pins suitably placed. If we consider that the core box shown is for the casting *E*, then the portion *D* would represent the diameter of the recess *X*. When a core box is made to the shape required, it is filled with a mixture of fairly coarse sand and a suitable binding material to hold it together, and then after removal from the box it is baked in an oven until perfectly dry and hard.

It may be mentioned here that the making of core boxes in pattern work requires fully as much skill as in the making of the pattern itself. Cores are sometimes reinforced by means of metal rods or bars of different shapes made to conform roughly to the shape of the core itself. In very long and slender cores, this support is quite necessary, as the core when baked is rather fragile and easily broken. Before the core is placed in the mold, it is given a coat of blacking composed of graphite or plumbago, so that the molten metal will not stick to it.

When a pattern requires a core to be used with it, it is necessary to provide some means whereby an impression will be left in the sand so that the core can be set into it after the pattern itself has been molded. In the example shown at *H* the flanged casting has a small hole through it, and this hole is so long that it would not be possible to form it in the manner mentioned as applicable to the example *E*. The pattern, therefore, would be made so that one end would have a tapered projection *L* while the other end would be straight, as shown at *M*. The tapered portion would indicate that this end is intended for the cope side of the flask, and the reason for its being tapered is so that the cope can be easily removed after molding. The two ends *L* and *M* are usually termed "core print," as they make a print or an impression in the sand of the mold in which the core is to be located.

The reader will understand the matter thoroughly by referring to the example shown at *N*. The shape of the work which is to be molded is seen at *Q* and the pattern is made with core prints at *P* and *O*. The core itself is made in a core box similar to the one shown at *B*, but having a shape to suit the form required. After the pattern has been molded it is removed from the sand, and the core, which has previously been baked, is set in the position shown. After this the two sides of the flask are carefully put together and the mold is ready for pouring. After the casting has been made, the core is very easily broken out, leaving the casting in the form desired.

When a casting is required of similar form to that shown at *A* in Fig. 579, two methods of molding are

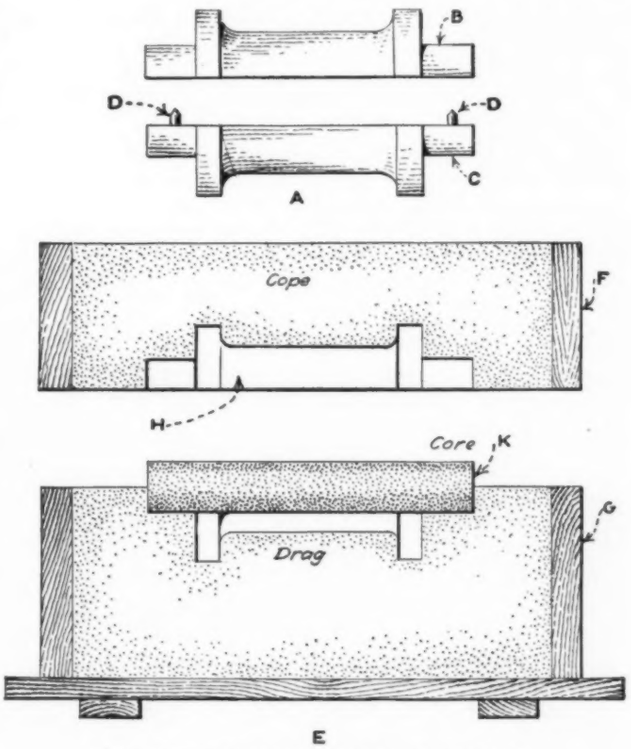


Fig. 580—Another method of molding, using two-part pattern

possible. If only one or two castings are required, the pattern may be made in one piece, as shown at *B*. When this is done, however, the molder is obliged to do considerably more work in order to mold the pattern. This fact will be easily understood by comparing the method with that shown in Fig. 580. It is obvious

that a core box is necessary in both cases, but the method of molding is considerably different. Both methods deserve consideration.

In the example shown in Fig. 579, the pattern would be laid on the mold board and the sand rammed around it in the drag portion of the flask in the ordinary manner. After this had been done the drag would be turned over and the molder would cut down the slopes at *C* and *D*, using a molding tool for the purpose; and he would remove the sand completely all around the pattern down to the center line *E*. This work would leave the upper half of the pattern clean and clear, and the molder would sift parting sand all over the drag side of the mold and place the cope flask in position, ramming it up in the usual manner. By using considerable care, the cope can then be lifted off so as not to disturb the sand which is hanging below it, as shown in the illustration. The pattern can now be removed from the drag and the core inserted as in the previous example. The greatest care is necessary when molding work of this sort, and it is doubtful whether there is any real economy in the method because of the extra care and labor required on the part of the molder.

In comparing the method just mentioned with that shown in Fig. 580, we must first consider the pattern itself as shown at *A*. This pattern is practically the same as the one shown in the previous example, except that it is cut longitudinally into two pieces. The upper half *B* has two dowel holes in it, while the lower half *C* has two pointed dowels *D* which fit the holes in the upper portion. Now in molding this type of pattern, the foundryman's work is much simplified, as he simply separates the pattern and molds the first piece in the drag *G* in the usual manner, as shown in the diagram at *E*. After completing the drag portion, the molder turns it over and puts the other half of the pattern in place, after which he puts on the cope side of the flask *F* and fills it with sand in the usual way. When the cope is lifted off, the impression *H* remains in this part of the flask and the core *K* can then be put into position, after which the cope is replaced and the mold is ready for pouring.

Equipping for Automotive Service

By J. Bainter

Good equipment is a requisite for shops that intend to do first-class service work on automotive engines. Hardly anyone doubts this statement, despite the fact that there are plenty of shops around the country that make a boast of their great service and yet have practically no equipment. Just to illustrate the point as to the desirability of proper equipment, the shop of George T. Bishop, in Shreveport, La., can be taken as an example. Of course, there are plenty of other men doing the same kind of work as Mr. Bishop and possibly with better equipment, but his shop is a good example of a progressive automotive service organization.

Mr. Bishop is a very active Dodge dealer and has devoted considerable time and thought to the future of his business. He believes that the less his customers have to pay for service and repairs the more cars he will sell. He aims to do a job right and at as little expense as possible to the car owner. Naturally, this means the right kind of tools and equipment for handling the work.

A view along one side of Mr. Bishop's shop is given herewith. Although not much can be seen on the bench beside the vises and a connecting rod fixture, it will be noted that neatness and order prevail, and that there is plenty or room to work. Also, an abundance of light comes from overhead.

The shop is not imposing in the equipment of machine tools that it boasts, among the principal pieces of equipment being a Franklin valve facing tool made by the Van Norman Machine Co., and a reboring machine made by the Universal Tool Co. An oxy-acetylene welding and cutting apparatus, here of use particularly for carbon burning, can be seen standing between two of the cars near the mechanic.

An interesting feature of this shop is that the mechanic must have his own tools and must guarantee the work that he does. The jobs are all done on a flat rate, so that a customer can be told quite accurately in advance what the expense will be for a certain type of job. The shop furnishes a set of outside and inside Starrett micrometers, and an Ames cylinder gage for checking the accuracy of the cylinders after they have been rebored. In order to do the reboring without removing the cylinder block from the chassis, the reboring machine already mentioned was installed. This machine is secured directly to the top of the block after the cylinder head has been removed. The power drive shown, with a ½-hp. motor, cut the time from 25 to 11 minutes per cylinder. The saving of time is quite important and affects greatly the cost of the job.

Cylinder reboring arrangement in automotive shop

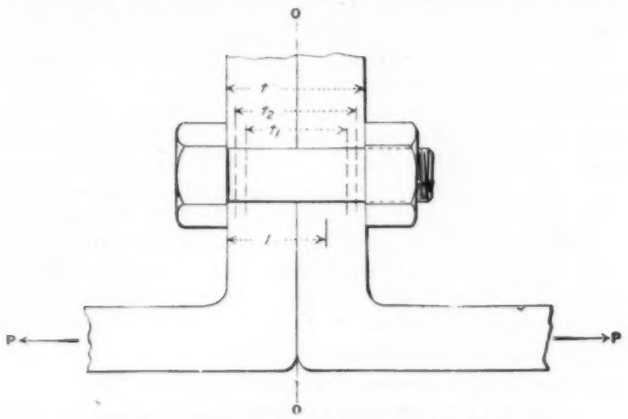
Effect of Initial Tension in Flange Bolts

By Melvin D. Casler
Assistant Engineer, Brooklyn-Staten Island Tunnel

Mathematical treatment for determination of stresses in bolts under various load conditions—Method of deriving the formulas—Numerical example to illustrate the solution

WHEN designing the bolts to be used for joining the cast-iron segments of tunnel rings, the old problem of the effect of the initial stress due to tightening upon stresses imposed later, presented itself. The mathematical solution of this subject is generally considered to be indeterminate. However, the following mathematical treatment of the problem was found to be of great value, and its principles can be applied to a large variety of problems.

If two flanges are bolted together with an initial tension of 20,000 lb. per sq.in. in the bolts, and then a



Sketch showing conditions possible in bolt holding flanges

web pull equivalent to 20,000 lb. per sq.in. of bolt area is applied, what is the resulting bolt tension?

An off-hand answer might assume that the total tension would be 40,000 lb. per sq.in. Instead of this, the following analysis would indicate a final bolt tension of 24,000 to 31,000 lb. per sq.in. for the conditions assumed.

The accompanying sketch represents two flanges in contact on plane *O-O* and clamped together by one or more bolts. After the bolts are tightened a pull P is applied as indicated. We wish to know the resulting tension in the bolts in terms of their initial tension and the pull P.

Flange Changes Under Load

In tightening the bolts the original aggregate thickness t of the flanges is compressed to the thickness t_1, and some original length l of the bolts is at the same time stretched to the length t_1. Then when P is applied the original length l is further stretched from t_1 to its final length t_2, and at the same time the aggregate thickness of the flanges expands from t_1 to t_2.

All deflection movements are referred to the plane *O-O* and are assumed as uniform over the whole flange; that is, bending of the flanges due to the action of P is neglected. The symbols used are as follows:

P = Total pull on each flange.
P_b = Total final tension in the bolts.
P_f = Total final compression between the flanges.
A_b = Cross-sectional area of bolts.
A_f = Area of flanges in compression.
S_i = Initial unit tension in the bolts.
C_i = Initial unit compression between the flanges.
S = Final unit tension in the bolts $= \frac{P_b}{A_b}$.
C = Final unit compression between the flanges $= \frac{P_f}{A_f}$
E_b = Elastic modulus of the bolts.
E_f = Elastic modulus of the flanges.
P' = Total pull on each flange at the moment of separation of flanges on line *O-O* (i.e., when $t_2 = t$).
S' = Unit tension in the bolts at moment of separation.

It is seen from the previous statement of the case that we have four different sets of conditions as follows:

(*a*) No bolt tension. $P = 0$.
Aggregate flange thickness $= t$.

(*b*) Bolt tightened. $P = 0$.
Aggregate flange thickness $= t_1$.

(*c*) Bolt tightened. P applied.
Aggregate flange thickness $= t_2$, with t_2 between t_1 and t.

(*d*) Same as (*c*) except $t_2 > t$.

For all conditions, $P_b = P_f + P$
From which, $SA_b = CA_f + P$
And, $$S = C\frac{A_f}{A_b} + \frac{P}{A_b} \qquad (1)$$

For condition (*a*) $S = 0$, $C = 0$, $P = 0$
For condition (*b*) $S = S_i$, $C = C_i$, $P = 0$
Hence from (1), $$S_i A_b = C_i A_f \qquad (2)$$

For condition (*c*) $$S = S_i + P\left(\frac{E_b + S_i}{A_b E_b + A_f E_f}\right) \qquad (3)$$

Equation (3) is derived from (1) as per computations given later.

For condition (*d*) $C = 0$
And from (1), $$S = \frac{P}{A_b} \qquad (4)$$

At the moment of separation on line *O-O*, $t_2 = t$, and conditions (*c*) and (*d*) occur simultaneously. Also $P = P'$ and $S = S'$. Making these substitutions in

(3) and (4), they become simultaneous equations, from which

$$P' = A_b S_i \frac{A_f E_f + A_b E_b}{A_f E_f - A_b S_i} \quad (5)$$

$$S' = S_i \frac{A_f E_f + A_b E_b}{A_f E_f - A_b S_i} \quad (6)$$

If P is greater than P' as given by (5), equation (4) must be used in place of (3).

The derivation of equation (3) is as follows:

$$E_f = C_i \frac{t}{t - t_1} \quad (7)$$

$$E_b = S_i \frac{l}{t_1 - l} \quad (8)$$

$$E_b = S \frac{l}{t_2 - l} \quad (9)$$

$$E_f = C \frac{t}{t - t_2} \quad (10)$$

From (7),

$$t_1 = t \left(\frac{E_f - C_i}{E_f}\right) \quad (11)$$

From (8) and (11),

$$l = t \left(\frac{E_b}{E_f} \times \frac{E_f - C_i}{E_b + S_i}\right) \quad (12)$$

From (9) and (12),

$$t_2 = t \left(\frac{E_b + S}{E_f} \times \frac{E_f - C_i}{E_b + S_i}\right) \quad (13)$$

From (10) and (13),

$$C = E_f \left(1 - \frac{E_b + S}{E_f} \times \frac{E_f - C_i}{E_b + S_i}\right) \quad (14)$$

Substituting in (1) the value of C as given by (14) and simplifying, we have the following equation (3). In the final reduction for (3), note equation (2).

$$S = S_i + P \left(\frac{E_b + S_i}{A_b E_b + A_f E_f}\right) \quad (3)$$

The application of the formulas can be best shown as follows, by an illustrative example:

Let $S_i = 20{,}000$ lb. per sq.in.
$A_b = 10$ sq.in.
$A_f = 50$ sq.in.
$E_b = 30{,}000{,}000$
$E_f = 12{,}000{,}000$

Then from (6), $S' = 30{,}010$ lb. per sq.in.
$P' = A_b S' = 300{,}100$ lb.

If $P < 300{,}100$, use equation (3).
If $P > 300{,}100$, use equation (4).
Let $P = 200{,}000$ lb.
($= 20{,}000$ lb. per sq.in. of bolt section).
Then from (3), $S = 26{,}667$ lb. per sq.in.
Let $P = 400{,}000$ lb.
($= 40{,}000$ lb. per sq.in. of bolt section).
Then from (4), $S = 40{,}000$ lb. per sq.in.

The foregoing derivations assume that the flanges are fully and uniformly compressed over the whole area A_f. This, of course, does not occur, and it becomes necessary to assume for A_f an equivalent area of uniform compression. It is obvious that the proper value to assume for A_f lies somewhere between the total flange area in contact on plane O-O and the minimum bearing area of the nuts or bolt heads. Suppose that in the above illustrative problem we had assumed $A_f = 100$ instead of 50 sq.in.

Then from (6),

$S' = 25{,}004$, instead of 30,010 lb. per sq.in.
$P' = 250{,}040$, instead of 300,100 lb.

And if $P = 200{,}000$,
$S = 24{,}000$, instead of 26,667 lb. per sq.in.
If $P = 400{,}000$,
$S = 40{,}000$ lb. per sq.in., as before.

If $A_f = 20$, $S' = 45{,}038$ lb. per sq.in.
$P' = 450{,}380$ lb.
And if $P = 200{,}000$, $S = 31{,}118$ lb. per sq.in.
If $P = 400{,}000$, $S = 42{,}236$ lb. per sq.in.

Book Reviews

Elementary Aeronautical Science. By Ivor B. Hart, B.Sc., A.F.R.Ae.S., and W. Laidler, B.Sc. 288 pp. 5x7¼ in. Published by Oxford University Press, American Branch, New York City. Price $2.75.

Both the authors are members of the civilian educational staff of the Royal Air Force, engaged in instructing aircraft apprentices, and the book is written primarily for these students. For this reason the calculations are arranged so as to be understandable by those with an elementary knowledge of mathematics.

The book starts with an outline or historical survey of the work of various men who have contributed to the knowledge and science of aviation including Leonardo da Vinci, Borelli, Lilienthal and others, down to the work of the Langley and the Wright brothers. There follow four chapters on the elementary principles of flight, which include the aerofoil, the lift drag ratio, stability and control and manoeuvre.

The last section contains six chapters on the airscrew, bending moments and other stresses in airplane structures, materials, description of airplane parts, instruments and engines. The work is arranged in text book style, with questions at the end of each chapter and explanations in text book language. The explanations are clear, however, and give much fundamental information that is too frequently not understood.

The book can be recommended for those who wish to study the theory and design of airplanes, and many other points of general interest. It does not deal with motor or plane construction or repairs.

Lathes: Their Construction and Operation. By George W. Burley. Published by Scott, Greenwood & Son, 8 Broadway, Ludgate, London, E.C. 4. Second revised edition. Cloth boards. Two hundred + VIII four and five-eighths by seven and three-eighths inch pages. Two hundred illustrations. Price 7s. 6d. net.

Starting with a history of the evolution of the lathe, the book describes lathes as we now know them, including turret lathes and lathe accessories. While, as the author states in the preface, the book was prepared with the object of presenting a survey of the whole field of lathe construction and operation from the descriptive point of view, the fact remains that the information given is but little more than that to be found in the catalogs issued by the makers of the machines described. From the title, one would suppose that some instruction would be given for operating the various kinds of lathes, but such information is conspicuous by its absence. Evidently the author has considered that a description of how the various speeds and feeds are set in motion, as covering the operation of the machines.

Like many of the English elementary books on mechanical subjects, there seems to be little need for its publication, other than for use as a condensed catalog of the machine represented.

A Backwoods Shop with Home-Made Machinery

By George Wilson

KNOWING that many readers of the *American Machinist* are interested as well in men and methods of a bygone generation as in modern tools and equipment, I venture to write of the little old machine shop that I discovered on a recent trip into the timbered hills of southern Indiana.

The moving genius of the shop has long been dead but, judging from the work he had accomplished, he must have been one of those old-time, all-round, born-to-the-cult mechanics of whom we often read but seldom meet, for all of the shop equipment except a small drill-press, a planer and one lathe is of his design and construction—built in the shop complete, from drawings to patterns, castings and finished machines. Not only is the shop equipment home designed and built but also the product (outside of job work) is the result of his genius.

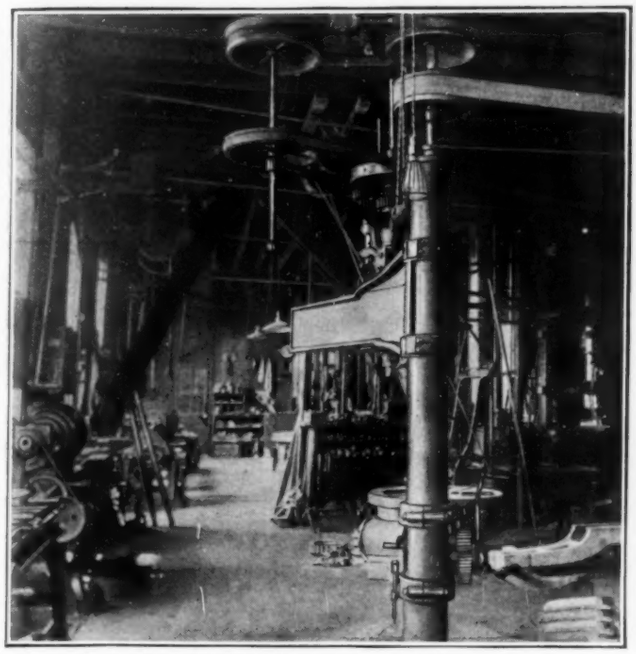


Fig. 1—The "iron" radial

The product consists principally of a steam tractor and farm engine, and a grain separator. The patent date on the steamer is 1885, but steamers had been built in the shop for some time before that date. One of the men said that he had worked with some of the present equipment when learning his trade 32 years ago, and is still using it. In fact, most of the original crew seemed to be still on the job.

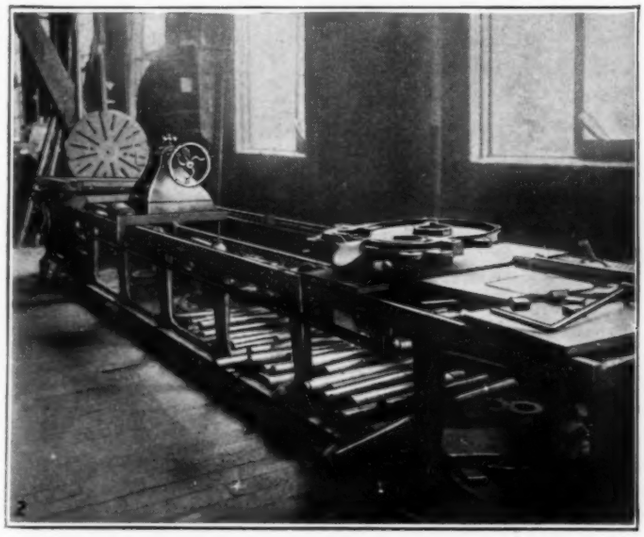
Machines Built of Oaken Timbers

The first machines were a lathe and a drill-press, built largely of oak. The lathe is still in use for pattern work. The bed is of oaken stringers to the upper surface of which strips of iron are fastened for shears, and the bearing surfaces of carriage and tailstock, also of oak, are pieces of square-sectioned iron let into the under side in the proper positions to rest on the shears.

The first drill-press consists of two heavy upright timbers with three pieces of the same material extending horizontally therefrom to carry the bearings of the spindle. There is no vertical movement of the latter, and feeding is accomplished by moving the table up and down the "column" by means of a treadle. The larger the drill, the heavier the weight imposed upon the treadle.

A radial drill, also built of oak, consists of two trussed members so hinged together and to a short post depending from the ceiling that the free end of the second member, carrying the spindle, may be moved about in any direction in a horizontal plane. The spindle has a vertical travel of 6 in. and is provided with a screw-operated feeding movement obtained by means of a hinged lever resting across the top of the spindle, a swivel nut at the outer end of the lever, and a single-piece screw, shaft and crankhandle extending downward within reach of the operator.

Though the hinged members are of 4x4-in. oak, they could not be expected to oppose rigid resistance to the upward pressure of the drill; therefore the swinging member is provided with a thrust pad that extends



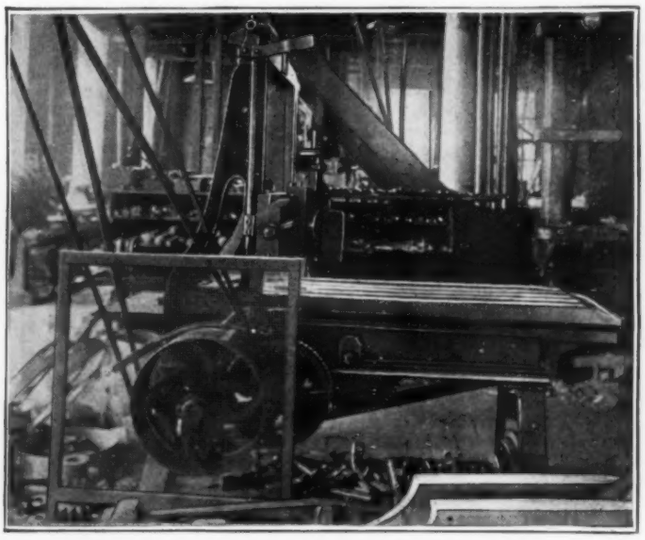
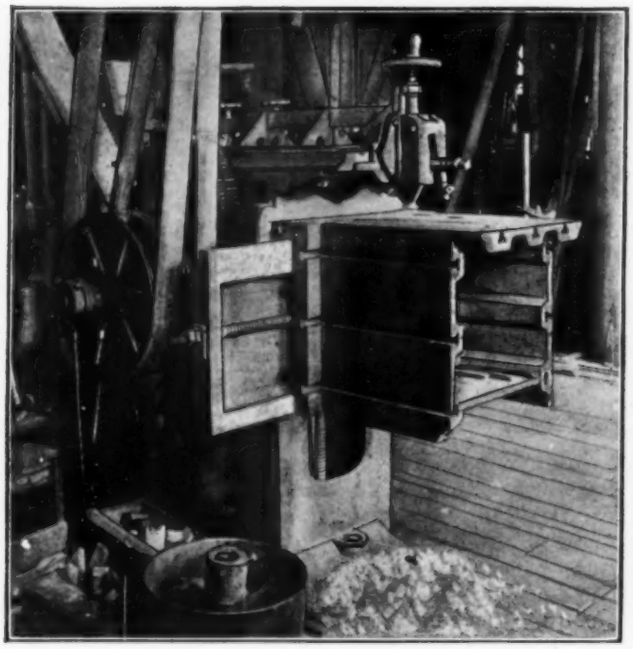


Fig. 2—A combination lathe and tool-storage rack. Fig. 3—The planer. One of the few "bought" machines



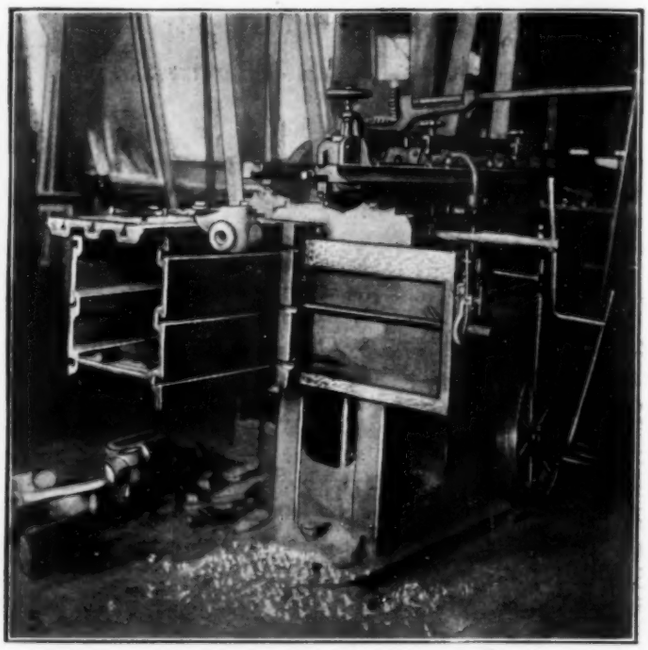


Fig. 4—A home-made shaper; driving side. Fig. 5—Operating side of shaper

upward and bears against the ceiling. To accommodate this pad the overhead floor joists are ceiled with oak planking over the entire area covered by the drill. This machine is used every day on such work as drilling boiler head flanges for rivets, boiler shells, and all work that is too large for the smaller machines.

A somewhat more ambitious attempt at drill building is shown in Fig. 1. This machine is of iron and is a sort of combination of radial and rigid type; having a swinging table like a regulation 20-in. drill-press and also provided with a radial arm, both of which can be seen back of the column. The machine extends from floor to ceiling, a distance of some 12 ft., and the spindle is driven by a system of horizontal belts and vertical shafts held by jointed arms so arranged that the head may be moved along the radial arm without interfering with the tension of the belts.

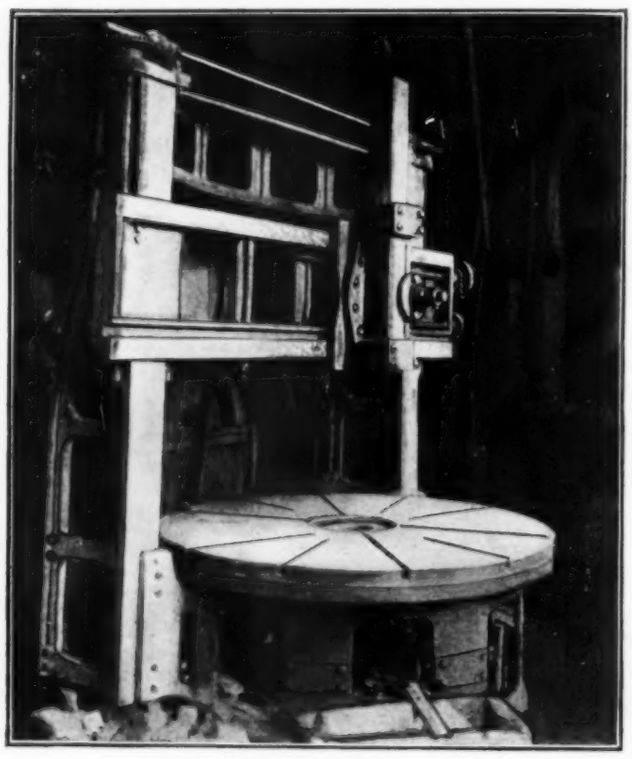


Fig. 6—The old boring mill

I endeavored to learn how the long column of this machine was turned, but there was difference of opinion among the workmen; some claiming that the turning was done on the lathe shown in Fig. 2, while others were equally positive that the job was sent out—though where it could have been sent would be difficult to determine.

The lathe was built in the shop. The front and back parts of the bed are separate castings, joined by the ends and cross-ribs which were bolted in place. The planer shown in Fig. 3—one of the few tools that had been bought outside—was only about half long enough to plane the shears of the lathe and so the latter were planed in two operations; one-half the length being finished and the casting then shifted along to plane the remainder.

Method of Holding Drills Not Unique

The method of holding drills in the lathe and drill-press spindles is open to criticism. There were no Morse taper sleeves, but instead there were collets fitted to the spindles to hold various sizes of drills. Straight shank drills were held in these collets, or adapters, by means of setscrews or by a cross-pin passing through adapter and shank. Have you ever noticed the condition of a stick after Towser has chewed upon it for an hour or so? This was the condition of those drill shanks.

Figs. 4 and 5 show a shaper that was also built in the shop. Note the skeleton ram. In reciprocating engines we endeavor to keep the weight of the reciprocating parts down to a minimum in order to relieve the shock of reversal, and the designer of this machine must have had this in mind when he drew the plans.

The reversing mechanism of the shaper is operated by adjusting tappets on the ram which strike the end of a bent lever alternately and, through it, move a horizontal rod that passes through the center of the bull-gear axle. On the other side of the machine are two loose pulleys revolving in opposite directions, and between them a double-faced cone clutch actuated by the sliding rod before mentioned. To hold the clutch in engagement in either position the rod has a raised conical "hump" that engages a pair of flat springs so arranged as to exert their tension in the direction in which the rod was last moved. Notwithstanding the crudity of this reversing mechanism it was very effective; the ram reversing instantly, but with a decided shock that suggested the frequent necessity of repairs.

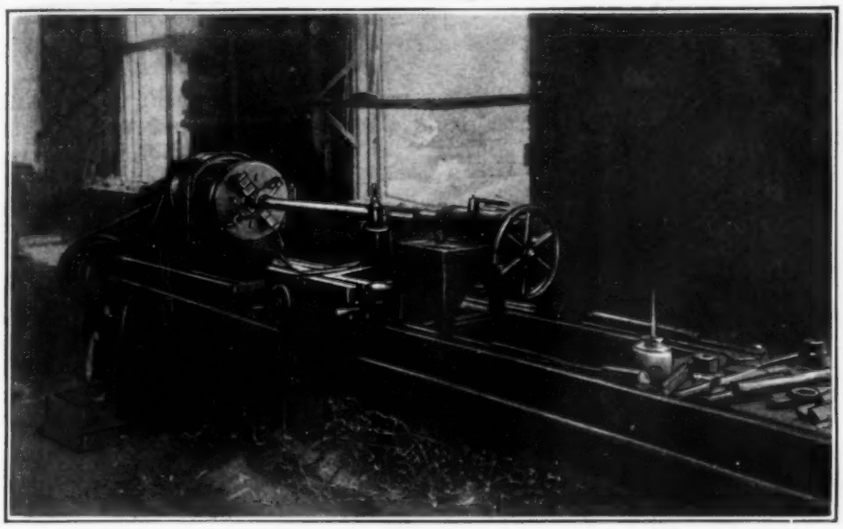


Fig. 7—The "best" lathe; also home made

Fig. 6 shows a boring mill the frame of which is cast in two parts, probably because the foundry had not the facilities for handling it complete. The feed screws are driven by sprockets and chains through a pair of opposed smooth-surfaced cones with a friction roller between them. Sliding this roller lengthwise of the cones adjusts the rate of feed. The mill is used principally to machine the engine flywheels and to bore the hubs of the driving wheels of the steamer.

The Shop Masterpiece

The lathe shown in Fig. 7 is one of the masterpieces of the shop. It is about 18 in. swing, with 20-ft. bed. The tailstock is a four legged affair with a bearing surface at each leg not more than 1½ in. long. The tailspindle screw does not go through the spindle but is tapped into the frame at one side and connects with the spindle by means of a yoke, as is common with modern dividing heads.

The apron of the carriage is a piece of ¾-in. boiler plate. A split nut connects the carriage with the leadscrew, which is also used for feeding, but there is no rack and pinion and the carriage must be yanked back by hand to start a new cut. A weighted rise and fall rest is provided, and the leadscrew nut is held in closed position by a similar, though smaller weight.

While watching the operator at work on this lathe I noticed that there was at least ½ in. of daylight between the carriage ways and the shear at one corner. I asked him how it was possible to turn anything straight on such a machine and he replied cheerfully, "Oh! you've got to know her." As he has been on the job for over twenty years it is probable that he has become thoroughly acquainted with "her" characteristics.

There was a clever device for stretching leather lagging on pulleys, consisting of a frame carrying a horizontal shaft fitted with reduction gearing, ratchet and crank handle after the manner of a hoist. Under the device was a row of small holes through the floor and through each of the holes was a rod terminating at its upper end in a hook and having a weight suspended from its lower end —down cellar.

A pulley to be lagged is mounted on the shaft and the end of a prepared piece of lagging riveted to it. A row of holes in the other end of the strip of lagging accommodates the hooks, and when all are attached there is considerable weight in the aggregate suspended from the leather lagging. Upon turning the crank the lagging is wrapped around the pulley under tension of the weights, and the ratchet holds it at any point while additional rivets are inserted.

Despite the crude nature of its equipment the shop turns out a very creditable product and has undisputed possession of the local field; which speaks well for the design and workmanship of the machines. There are a goodly number of the rigs in service and no small part of the work of the shop is in the way of repairs and replacements. About six new rigs are turned out each year.

The workmen are all "home folks" who have learned their trade in the shop. Wages are low, but the men all own their homes and are content. The young man who runs the "iron" radial has been on the job five years and cannot get an advance until some other operative dies. Apprentices used to get as much as twenty-five cents a day, and the term was five years.

Oak is the most plentiful thing in the locality. Not only are the machines built of it but the frame of the shop is of white oak. The big window sash slide horizontally into the wall instead of raising in the usual way.

The line shaft is 1½ in. in diameter. The pulleys are practically all home-made of the all-existent oak. The widest belt in the shop is 4 in. Most machines run along at one speed, for, though there are overhead cone pulleys for most of them, it is too much work to get a stick and shift the belt.

Whenever I hear a man in a modern shop complain of his machine or tools I wonder what he would do in that little old shop if he were confronted with the job of boring a 9½x12-in. cylinder, *straight, true and smooth*, on that lathe with the four-legged tailstock and the daylight under the carriage. Could he make "her" do a creditable job in five hours?

[This article is of interest for purposes of comparison. Because it is no longer necessary for men to waste time in coaxing good work out of inadequate machinery we now produce such work as automobiles and watches at remarkably low costs. We appreciate the work of the old time mechanic but a modern apprentice knows much more about real accuracy.—Ed.]

Ideas from Practical Men

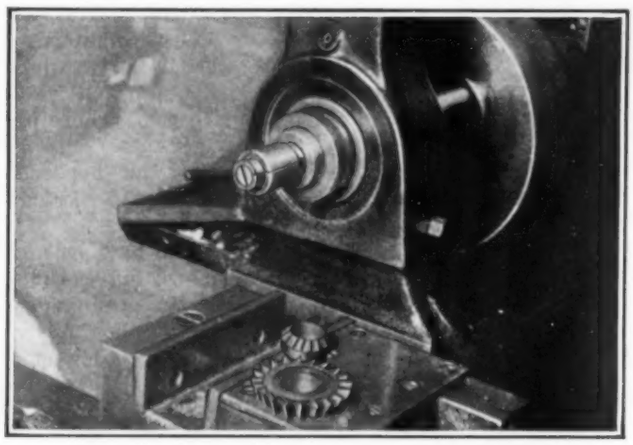
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

An Expanding Arbor for Milling Cutters

BY MILTON WRIGHT

The illustration shows a stud arbor to be used for holding small milling cutters, saws, etc., when the nature of the work is such that there is no room for the arbor to project beyond the cutter. With this arbor it is often practicable to use a side or angle cutter of appreciable diameter, when otherwise only an end mill could be used.

The arbor is first turned to size and shape with the shank fitting the center-hole of the milling-machine spindle, leaving a sufficient length beyond the large end of the taper to bring the cutter out to a convenient



Convenient stud arbor for small milling cutters

working position. The bearing for the bore of the cutter should be equal in length to the thickness of the thickest cutter that is intended to be used with it. If narrower cutters are to be used, several collars of different thicknesses may be made to go behind the cutter.

A substantial key should be let into the arbor to fit the keyway usually to be found in the bores of milling cutters. Owing to the necessarily short bearing of the arbor in the bore of the cutter, the friction cannot be depended upon to do the driving, if appreciable cuts are to be taken.

Having gotten this far in the making, two small holes are drilled through at right angles to the axis of the arbor and also at right angles to each other, at a point that will be just outside the end of the milling machine spindle when the arbor is in place. Next, the arbor is swung up in a lathe with the outer end in a steady-rest, just enough out of parallel with the center line of the lathe so that a hole bored in the end of the work will be slightly tapered; say 5 deg. In this position a central hole is bored back as far as the intersection of the small cross-holes, and is threaded about 20 pitch.

A plug is then made with corresponding taper and thread to fit the hole, and when this is screwed in tight it is marked flush with the end of the arbor, withdrawn, cut off at the mark and slotted for a screwdriver. It should also be hardened; and if the necessary appliances are at hand for grinding the arbor to size after hardening, it, also, should be hardened.

Before hardening the arbor, however, it should be set up in the milling machine and sawed through in two planes at a right angle, corresponding to the cross-holes already drilled. These holes will furnish the run-out for the saw. As thin a saw should be used as is conveniently possible. After hardening and grinding to size, the arbor is ready for use.

Planing Driving-Box Shoes

BY H. A. SAMUELS

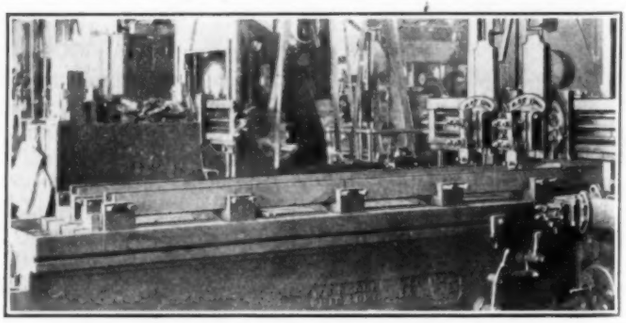
A very simple set of fixtures for planing driving-box shoes is shown in the accompanying illustration.

As will be seen, the fixtures are cast-iron bars or straps having vertical members at the ends and provided with setscrews to hold the shoes. They are cheap to make, easy to handle, and can be stored in a very small space.

Enough fixtures are provided so that the shoes can be strung out in two rows, the full length of the planer table, thus utilizing both heads of the planer.

The shoes are planed in four settings, the last setting bringing them into position for planing both the tops of the side pieces, and the three inside surfaces.

The tools for planing the inside vertical surfaces con-



Planing driving-box shoes

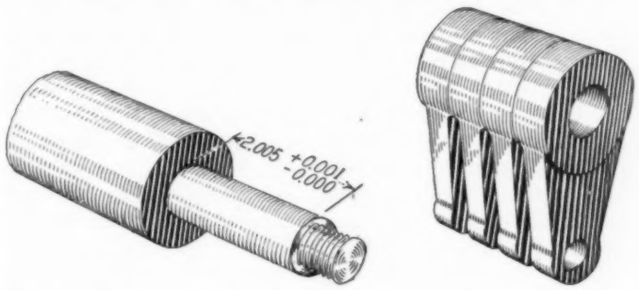
sist of machine-steel holders, each provided with two tool bits set at an angle. Both sides are planed at once and, with the tool bits properly set, the sizing is automatic.

The fixtures described are in use in the Richmond Hill Shops of the Long Island Railroad, Morris Park, Long Island.

An Example of Unilateral Tolerance

By Charles F. Henry

I ran across an excellent example of unilateral tolerance the other day which showed its advantages quite clearly. The four arms shown fitted on the shaft in the illustration, must move freely, but without undue end motion. Each arm was nominally ½ in. thick at the hub, and had a minus tolerance of 0.001 in. The stud on which the arms swung had a length of 2.005 in., with a plus tolerance of 0.001 in. and no minus tolerance. These dimensions gave a minimum tolerance of 0.005 in.



An example of the advantages of unilateral tolerance

and a maximum tolerance of 0.010 in., but in no case could the arms be locked tight against the shoulder, so as to prevent motion.

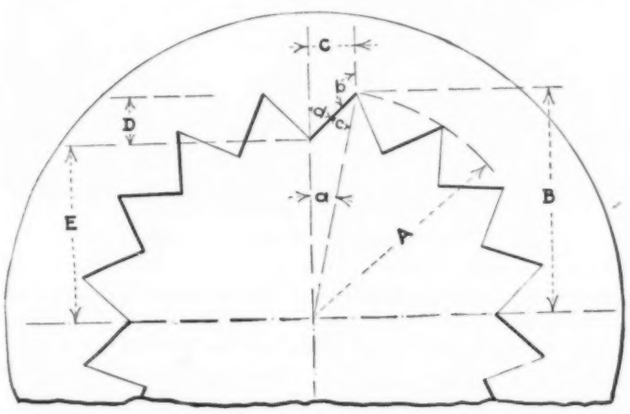
The small jobbing shop making this apparatus was so particular to have unilateral tolerances on all blueprints, that it has secured the permission from the party for whom it was doing the work to change the tolerances on the blueprints in accordance with the unilateral system.

The ease with which the drawings could be dimensioned for unilateral tolerances as compared with the difficulty of the bilateral system, in such a case as this speaks volumes for the advantages of the unilateral method.

Formula for the Bore of a Serrated Splined Hole

By Harold R. Sleeper

Before machining the serrations in the hole shown in the accompanying sketch, it is necessary to find the diameter of the hole which must be bored at the center.



Finding the bore of a serrated splined hole

Such a hole is necessary to admit the cutting tools for the splines, and its diameter is equal to the diameter at the points of the serrations.

Using the symbols from the sketch, the problem is to find the distance $2E$, having given the number of serrations, N, the outside diameter of the splined hole, $2A$, and one-half the angle of the serrations, c. In some cases the angle d, which is one-half the angle of the cutter may be given instead of c.

$$\text{Angle } a = \tfrac{1}{2}\,\frac{360}{N} = \frac{180}{N}$$

$$\text{Angle } d = a + c = \frac{180}{N} + c$$

$$\text{Angle } b = 90 - d = 90 - \frac{180}{N} - c$$

$$B = A \cos a$$
$$C = A \sin a$$
$$D = C \tan b$$
$$2E = 2(B - D)$$

Computing a Connecting Radius—Discussion

By John Homewood

A perusal of Hubert G. Smith's computations for a connecting radius, on page 456, Vol. 59, of the *American Machinist*, led me to investigate the possibilities of an easier method.

The diagram herewith shows a graphical method, and is also the basis for computations which are consider-

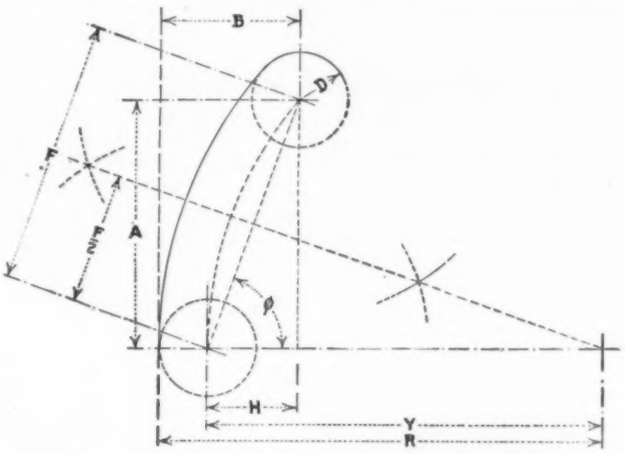


Diagram for computing connecting radius

ably simpler than those given in the above-mentioned article. Using the symbols of the previous solution, the problem is to find the radius R, having given A, B and D.

$$H = B - D$$
$$F = \sqrt{A^2 + H^2}$$
$$\cos \phi = \frac{H}{F}$$
$$Y = \frac{F}{2 \cos \phi} = \frac{F^2}{H}$$
$$R = Y + D = \frac{F^2}{H} + D$$

The graphical method for solution is shown by the dotted lines in the accompanying diagram.

Putting Brass Liners in Hydraulic Jacks

BY CHARLES F. HENRY

There is a little knack in putting liners in hydraulic jacks, and making them tight so the liquid will not get between the liner and the body when heavy pressure is used. Fig. 1 shows a brass liner forced into a steel

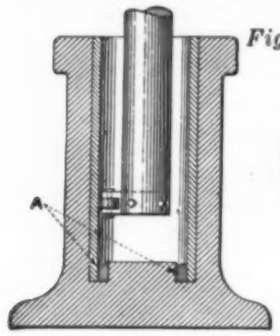


Fig. 1

Fig. 1—Rolling and calking liners.
Fig. 2—Rolling tool

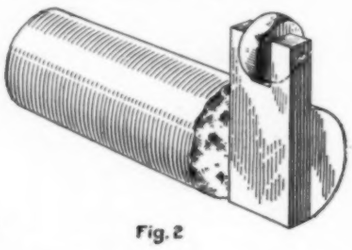


Fig. 2

body. As will be noted, there is a recess in bottom of the body, about three times the thickness of the liner. This allows for a copper ring to be put in at *A*, between the liner and the body. Calking the ring forces the lower end of the liner against the wall of the body, effectually preventing any leakage.

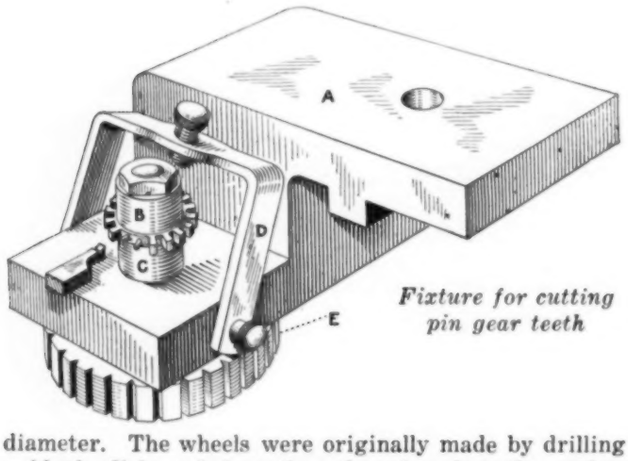
The liner is then rolled by a substantial tool held in the end of a good sized bar as shown in Fig. 2. The roller has a crowned surface so as to avoid any cutting or marking of the liner as it is forced down the bore. After rolling, the bore of the liner is lapped with a babbitt lap charged with abrasive. The lap is expanded by means of wedges when it wears below size.

Turning Teeth on Pin Gears

BY HERBERT F. CRAWFORD

In a certain type of recording mechanism there is used a round-tooth pin gear for moving a perforated tape. This gear is of steel, approximately 1 in. in diameter, and with teeth somewhat less than $\frac{1}{8}$ in. in

Fig. 1



Fixture for cutting pin gear teeth

diameter. The wheels were originally made by drilling a blank disk and inserting the pins, but the maker decided that a much better job could be made by cutting the teeth from the solid. For this purpose he made the fixture illustrated herewith, in which the base *A* fits over the toolblock of a precision lathe the tongue shown fitting into the toolpost slot.

The blank to be cut is clamped between the two collars *B* and *C*, so as to be central with the lathe spindle. These collars hold the blank firmly and also support it while the teeth are being cut. The stirrup *D* swings forward into a vertical position, so that the setscrew comes centrally over the spindle and gives it additional support at the upper end. On the lower end of the spindle is the index disk *E*, which insures accurate indexing.

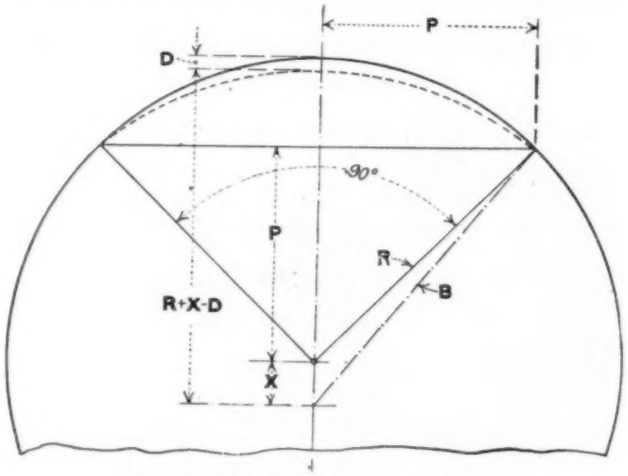
The actual cutting of the pin teeth is perhaps the most interesting part, owing to the form of tool used. The wheel is first roughed out or gashed, to remove as much metal as possible before forming the pin tooth itself. The usual method in such a case is to use a small hollow mill for the finishing, but it was found to leave marks on the work, and also failed to give the exact rounded form to the tops of the teeth, as called for in the specifications. So the hollow mill was abandoned, and a single-point tool, somewhat as shown in the small sketch, and held by a chuck in the spindle, was used for this purpose. It is in reality an end-cutting lathe tool with considerable top rake and having the side ground so as to give the proper radius to the tops of the teeth when the front cutting edge reaches the bottom of the cut. This is believed to be a new method of machining work of the kind, and the results are highly satisfactory in every way.

Computing Offset for Relief Grinding—Discussion

BY W. ROLAND NEEDHAM

Under the above heading, Clarence D. Scrom gives, on page 709, Vol. 59, of the *American Machinist*, the method by which he calculates the required offset allowance. He attacks the problem in detail and builds up his final result cumulatively.

The following discussion shows how by working on orthodox lines the whole solution may be boiled down



Relief grinding offset for piston

to a fairly simple formula. The notation agrees with that given in the original solution, one or two symbols however, being omitted. The writer merely offers this as an alternative treatment and, because the derived formula is not unwieldly, it may interest certain readers.

Referring to the accompanying sketch, it is desired

to relate the offset X to the depth of recess D. The two following relations are obvious: First, since the two distances P are equal, $P = \frac{R}{\sqrt{2}}$; second, $B = R + X - D$. Now taking the triangle whose sides are B, P, and $P + X$, respectively, we have

$$B^2 = (P + X)^2 + P^2 = \left(\frac{R}{\sqrt{2}} + X\right)^2 + \left(\frac{R}{\sqrt{2}}\right)^2 = R^2 + X^2 + \sqrt{2}(RX)$$

also,

$$B^2 = (R + X - D)^2 = R^2 + X^2 + D^2 + 2RX - 2DX - 2DR$$

$$\sqrt{2}(RX) = D^2 + 2RX - 2DX - 2DR$$

$$(2 - \sqrt{2})RX - 2DX = 2DR - D^2$$

$$X = \frac{D(2R - D)}{0.5858R - 2D}$$

Taking the numerical example given in the original article, where $D = 0.017$ in. and $R = 2.12325$ in.,

$$X = \frac{0.017(4.2465 - 0.017)}{(0.5858 \times 2.12325) - (2 \times 0.017)} = 0.05944 \text{ in.}$$

Mr. Scrom obtains 0.0598 in. with his method and thus the results agree very closely.

Low-Cost Boring Fixtures

By Francis C. Henry

It is interesting to note how mechanics in shops many miles apart solve their problems in a very similar manner. Two boring jobs, both parts of small machines, are bored on the same principle, by being held

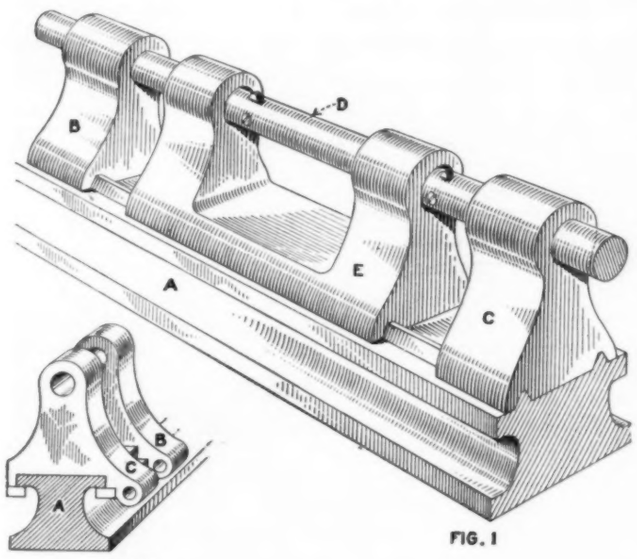


FIG. 1

FIG. 2

Fig. 1—Simple boring device for headstocks. Fig. 2—Boring milling machine supports

on portions of the machines for which they are being made, as shown in Figs. 1 and 2.

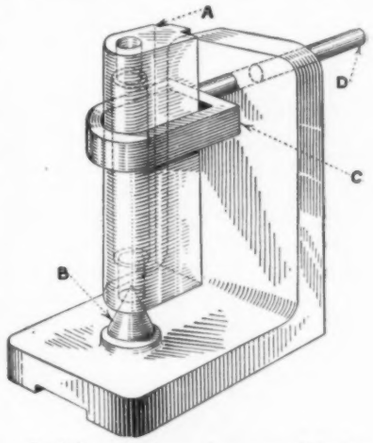
The first job, shown in Fig. 1, is a small precision-lathe headstock and it is bored on an 18-in. engine lathe in a very simple manner. A portion of one of the lathe beds, shown at A, is bolted to the lathe-carriage in line with the centers. The two heads B and C are fastened securely to this portion of the lathe bed, and guide the boring bar D. The headstock E, is fastened to the lathe-bed section A, just as it will be on the finished lathe. The boring bar D is inserted, the single-point cutter put in position and the holes bored in both ends of the headstock. By using two sets of cutters it is very easy to rough bore these holes and then finish with a very light cut, which gives round and straight holes.

A somewhat similar job is shown in Fig. 2, where the outer supports for a small milling machine are being bored in a horizontal boring machine, using a section of the milling-machine bed A, for holding the work in the proper position. The holes are easily located by using a standard support B, as a guide for the drill and boring bar. The guide B is then fastened to the bed A while the work C is easily slipped on over the end and fastened close to the guide, leaving room for the chips to come out between the two pieces. Both the holes are bored in this way and the method has proved very satisfactory. The holes in guide B had been bored out and hardened bushings inserted, which can be easily replaced in case of wear.

Drilling Cored Holes

By W. F. Sandmann

The spindle bearing shown in the illustration is part of a multiple spindle drill-press assembly. The first machining operation is drilling the cored holes in the ends of the bearing, each hole being about an inch long. The hole through the middle of the bearing is not machined, but is cored large enough to form a relief.



Drilling fixture for cored holes

Difficulty was experienced in drilling these holes so that a line reamer would clean them up smoothly. The fixture shown solved the problem. The bearing A was dropped on the cone center B, and held in position by the floating yoke C. The yoke was large enough to allow the bearing to float, the yoke being merely a means of preventing the bearing from turning with the drill, and to hold it in an approximate upright position until the drill could enter.

One end of a bearing would be drilled and then it would be turned over and the other end drilled. It would then be removed from the fixture and a hand reamer run through both holes at the same time, cleaning them up and giving a good line reamed job. Seldom over 0.003-in. stock would be removed by the reamer because of the accuracy of the drilling.

This method will be found successful on any job of core drilling from opposite ends. If the castings come very rough around the holes, they should be slightly countersunk on one end so they will set centrally over the cone center. Different shapes and kinds of yokes can be used on the same fixture, as the yoke rod D is only a loose fit in the fixture.

American Machinist

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KENNETH H. CONDIT AND FRED H. COLVIN
Editors

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Is Washington a Mirror?

THE BELIEF that Congressmen are typical of citizens they represent is rather general. If they are, how proud we ought to be of ourselves.

At present there is little to choose between the two bodies that form our national legislature. The Senate has taken to the oil scandal as an eel takes to mud. Partisanship of the most unpleasant kind is rampant and senatorial dignity is in the nature of a tradition, and a little-observed one at that.

The House is making a spectacle of itself in its handling of tax matters. Here again partisanship has been permitted to crowd out the calm deliberation due such an important subject as tax revision. A plan carefully worked out by experts under the supervision of probably the ablest Treasury secretary since Hamilton was thrown aside for a measure brought forward solely as a partisan stop-gap and hopelessly inadequate and ill-considered. At the last moment some measure of political sanity seemed to return to several members of the group that made possible the passage of a minority party bill and the Longworth compromise emerged as the final action of the House. What the Senate will do is problematical.

Does this exaggeration of partisanship truly represent the attitude of the American voter? In other words, does Congress mirror the opinions and desires of the country? If it does, it is high time that each one of us took time to overhaul his mental processes and examine into his own political ideas, if he has any. If Washington is not a mirror of the rest of the country isn't it about time that we took vigorous steps to make it one?

Getting and Keeping Young Men in the Shop

IN SPITE of the great increase in automatic, semi-automatic and single purpose machinery there is still a growing demand for skilled mechanics. A high executive of one of the largest concerns in the country is worried about the problem of getting enough young men who will stick long enough to learn to be thoroughly good mechanics and who will stay on the job after they have learned.

In some cases the reason is easy to find, the money offered is not sufficient for a young man to live on, even if he desired to learn the trade. This reason does not hold in the case referred to because he is perfectly willing to start a young man at a higher rate than the journeyman received a few years ago. But still he does not get enough of the right kind of young men to satisfy his needs and he fears a great shortage in a few years.

Not many miles away is another concern which, though small in comparison with the one first mentioned, would have been considered large ten years ago. It is noted for its apprentice school and the training it gives, and is also known by the mechanics of the city as a good place to work. The apprentice school in this plant has more applicants than it can handle, a large percentage of them being high school graduates.

It is not a question of money, for while the small company pays its apprentices well, the rate is a trifle lower than that paid by the larger company. One reason for the difference is that there are fewer opportunities in other lines in the small city. Another is that there is not the same false pride about getting one's hands and clothes dirty. The main reason, however, is probably that the officials of the smaller plant have taken a special personal interest in the school, that they have studied the problem of attracting and holding the kind of boys they want and that there is more of a personal atmosphere about the whole plant.

Whatever the reason, the plant with the well filled school is building up a corps of loyal workers, of young men who will to a great extent be excellent material for foremen and leaders in the shop. And this is an asset which cannot fail to have its effect as the years go by. As competition becomes more keen the plant with a good supply of carefully trained men, to whom the shop school is an alma mater, will have the advantage over even much larger plants in which this spirit does not prevail.

The Popularity of Technical Books

OUR OWN book company has just sent us a copy of its latest catalog, a volume that compares favorably in size with many of the books it lists. The range of subjects included is astonishing, particularly when one stops to consider that the books listed under each subject treat it only from what may be called an applied science angle.

The main fact that we find worthy of comment, however, is that books of this kind, technical books, are so widely read. The average man considers a technical book pretty dry stuff, only to be tackled with the aid of ample leisure, a good supply of midnight oil and plenty of tobacco. Even then he is oppressed with a pessimistic doubt of his ability to assimilate the information in front of him.

But evidently there are exceptional individuals who do not share the general feeling. Book companies do not continue long in business unless people buy their books. These men are the ones to whom we look when specialized knowledge is needed to cope with difficult situations. They get their basic principles from technical books and keep abreast of the latest practice by reading the technical periodicals. Their influence on industry and civilization has always been powerful, but only lately have they as a class, the engineers of the world, begun to receive the recognition they deserve.

Let us hope that the recognition will be accorded in increasing measure so that they can enjoy it while they are still alive.

Shop Equipment News

Betts 100-In. Double-Driven Vertical Boring Mill

The Betts Machine Works of the Consolidated Machine Tool Corp. of America, Rochester, N. Y., has recently placed on the market a 100-in. vertical boring mill, in which is incorporated a number of improvements over former models.

An important feature is the table drive mechanism which consists of two spur pinions meshing with an internal gear of wide face and coarse pitch, mounted beneath the table. The pinions are keyed to their shafts so that each meshes evenly with the table gear, and are located on opposite sides of the gear to produce a smooth-running drive. The mechanism is designed to handle work requiring heavy cuts and coarse feeds in steel castings.

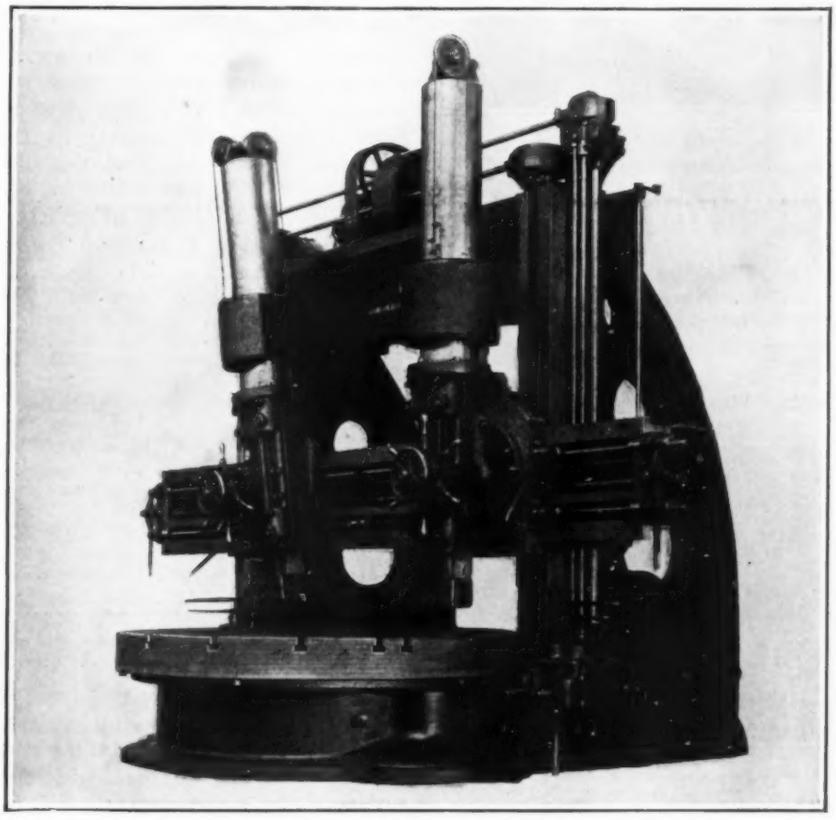
The table is of extra thickness and is mounted on a long spindle which is provided with taper bushings for adjustment of wear at both top and bottom bearings. These bushings are provided with means for automatically lubricating the bearings.

The saddles and tool spindles have eight feeds which are entirely independent for each side of the machine. Feeds are obtained through sliding steel gears and can be changed from one to another instantly while the machine is running. The power rapid traverse to the saddles and tool spindles is driven by a motor on top of the machine, used also for raising and lowering the crossrail. The arrangement of power rapid traverse is such that there are no idle running shafts or gears, as the top works is not in motion except when power rapid traverse or crossrail elevation is being used. The feed and power rapid traverse are positively interlocked by a cam arrangement which throws one out before the other is engaged.

The power rapid traverse and feeds may be engaged, disengaged or reversed directly from the saddles by means of an arrangement of levers fastened to the operator's side of each saddle. Duplicate stationary levers are provided on each side of the machine for use when the crossrail is in a high position, and an interlocking lever is provided at each end of the crossrail for selecting horizontal or vertical movement. Feeds and power rapid traverse are reversed by means of friction clutches, thus protecting the machine against damage and enabling all movements to be made with rapidity. Crossrail feed screws and elevating screws are provided with roller bearings for taking the thrust.

The tool spindles are counterbalanced by means of ring-type counterweights, the design of which provides uniform counterbalance at all angles and eliminates overhanging chains and sheaves. The spindles have a friction locking device for operating the rack pinion, allowing the operator to raise or lower the spindle quickly by hand, if desired, in addition to the power rapid traverse.

The crossrail has a wide face, is provided with narrow guide and is carried back between the uprights to provide stiffness when the heads are near center. The driving motor is direct-connected through gearing to the speed box. On a.c. motor-driven machines a speed box, providing twelve table speeds in geometric progression through hardened steel sliding gears, is furnished, together with a friction clutch and brake for starting and stopping the machine, independent of the motor, from either side. Machines driven by d.c. motors have three mechanical speed changes which, in connection



Betts 100-In. Double-Driven Vertical Boring Mill

with the 3 to 1 adjustable speed motor recommended, gives a total speed range of 27 to 1. A field rheostat and dynamic brake in the motor controller, in connection with push button control, provide means for quickly stopping or changing speed.

Bolender Gear Grinding Chucks

The Bolender chuck for holding gears accurately while grinding the bore, so that the bore will be concentric with the teeth, is now being marketed by the City Engineering

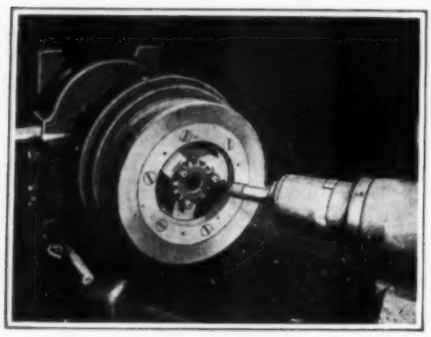


Fig. 1—Bolender No. 1 Gear Grinding Chuck

Co., Fourth and St. Clair Sts., Dayton, Ohio.

The chuck is made in two sizes of which the No. 1, shown in Fig. 1, is adapted for holding gears from the extremely small sizes to a 21-tooth, 6-8 pitch gear. The No. 2 chuck, illustrated in Fig. 2, will

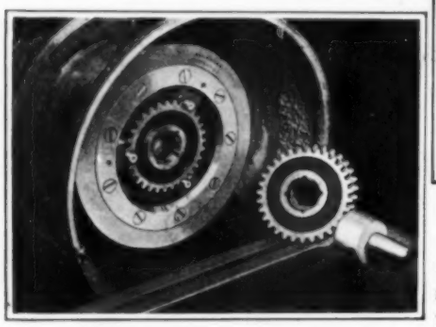


Fig. 2—Bolender No. 2 Gear Grinding Chuck

handle up to 31-tooth, 6-8 pitch gears. These capacities are available with standard jaws and, by using special jaws, either size can be made to hold parts as large as the outside diameter of the chuck.

The device may be furnished with either three or five jaws, each jaw being equipped with a hardened and ground steel pin when holding spur gears. It is claimed that by this means spur gears are held concentric within 0.001 in., without particular attention by the operator.

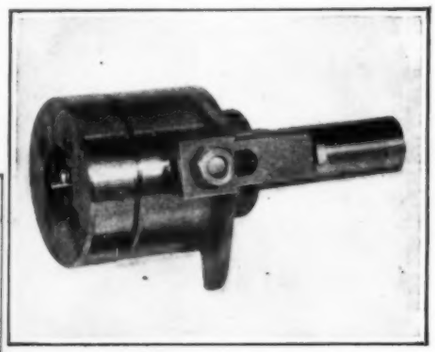
The jaws are located in slots in the body of the chuck and are forced toward the center for gripping the work by a ring with an inside taper which fits the back of the jaws. The ring is moved by a nut with a square thread, located on the rear end of the chuck body. The jaws are moved outward by spring action when the tapered ring is moved forward, thus releasing the work.

It is claimed that the chuck is oil-, water-, and dust-proof, and that the time required for chucking the work is exceptionally short. The use of special jaws makes the chuck available for spiral bevel ring gears, worms, cluster gears, etc., as well as spur gears.

Murchey Type P Diehead

A self-opening diehead, designed especially for use on Brown & Sharpe automatic screw machines and designated type P, has recently been placed on the market by the Murchey Machine & Tool Co., Detroit, Mich.

This device is similar in construction to the type O diehead manu-



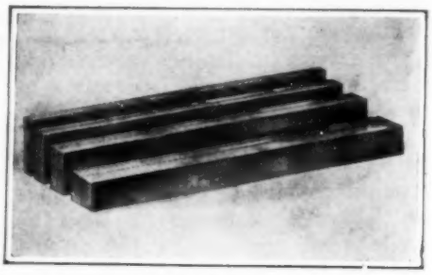
Murchey Type P Diehead

factured by this company, and is shown in the accompanying illustration. The head is closed by the projecting arm at the side which is arranged to make contact with a suitable stop on the machine. The opening of the head at any predetermined point is controlled by the adjustable lug on top of the device and, since the parts of the tripping mechanism are provided with large hardened bearing surfaces, the efficiency of the mechanism is not affected by constant tripping.

A feature of the device is the use of comparatively few parts in its construction, all of which are interchangeable. Close adjustment of the chasers can be easily and conveniently made, and the hobbed chasers are made of high-speed steel. The chasers and other working parts of the head are inclosed and tipping of the chasers is prevented by the construction of the mounting. All working parts are hardened and ground to insure long life under severe service.

Starrett Hardened and Ground Steel Parallels

A recent addition to the line of small tools made by the L. S. Starrett Co., Athol, Mass., consists of two



Starrett Hardened and Ground Steel Parallels

sets of parallels. A special grade of tool steel is used in the manufacture of these tools, and they are hardened and ground.

The sets consist of eight pairs of parallels and can be furnished in individual pairs, combinations of pairs, or complete. The dimensions have been determined from experience to make the most practical combinations, and all are 6 in. long. The No. 1 set is shown in the accompanying illustration.

Industrial Prospects in Argentina

There are good prospects in Argentina for agricultural machinery and tractors for which inquiries are increasing, regular inquiries for industrial machinery, American cotton machinery being in high favor, and the hardware movement is good. European machine tools have a heavy price advantage over American goods. The lumber market is also good. Ten cargoes of pine have arrived from American southern ports since Jan. 1. The cotton textile prospects are better. American voiles and cotton flannels are selling well, the English have a large poplin trade and Italian white goods are coming in. German and Belgian steels are enjoying price advantage, but American iron tubing, tinplate and corrugated iron are in demand.

News of the Week

Annual Reports Show Most Companies in Prosperous Condition

Several records made by metal working industries

Reports from several manufacturing companies show that most of the big corporations and companies are prosperous and that business during 1923 was better than for the two years preceding and prospects are for a continued activity during the present year. Several records were established by manufacturers both for the volume of production and for the earnings. Below are some of the reports made last week:

The American Locomotive Co. for 1923 reports net income of $12,376,564, the largest yearly total in its history. Gross sales aggregated $90,180,176, the second largest annual total on record. The net income for 1923, after allowing for all charges, taxes and dividends on the preferred stock, was equal to $21.23 a share on the 500,000 shares of par value common stock outstanding. In 1922 the company failed to earn its preferred dividends.

After payment of dividends on all the preferred stock and the increased common stock, the company reported a surplus of $8,126,564. From this account there was deducted $4,500,000 as reserve for additions and betterments, leaving a net surplus of $3,626,564. The profit and loss surplus on Dec. 31 was $26,965,199, against $23,338,635 on the same date in 1922.

Other Increases

The Air Reduction Co. for 1923 reports record-breaking gross earnings and net profits. Gross business last year aggregated $10,201,061, against $7,021,209 in 1922, and net profits for the stock of $2,138,023, against $879,507 in 1922. The balance available for the 173,586 shares outstanding at the close of 1923 was equivalent to about $12.30 a share, against $5.61 in 1922.

The Timken Roller Bearing Co. for 1923 reports net profits of $8,096,803, after providing for all expenses and charges. This compares with $7,724,029 in 1922. The net profits for 1923 were equal to $6.74 a share earned on the 1,200,000 shares of no par value stock outstanding, against $6.43 a share the previous year.

The report of the Railway Steel Spring Co. for 1923 shows net earnings of $3,341,271 after charges, depreciation and Federal taxes, equivalent, after preferred dividends, to $17.75 a share on the outstanding $13,500,000 of common stock, as compared with $2,327,294, or $10.23 a share in 1922.

The Chandler Motor Car Co. reports for 1923 $4,012,189 profits, the largest for any year since the boom period of 1920. This compares with $3,952,572 in 1922 and $1,890,319 in 1921. Total income for 1923, including that derived from other sources than operations, was $4,041,373, against $3,995,778. After all general expenses, reserves for taxes and other deductions, there was reported $2,055,267 available for the stock, equal to $7.34 a share on the 280,000 shares. In 1922 the company reported earnings equal to $6.09 a share.

The Fisher Body Corp. reports for the quarter ended Jan. 31 net earnings of $6,775,205, after allowing for all expenses and depreciation charges. This compares with net earnings of $6,276,405 in the October quarter. For the nine months ended Jan. 31, 1924, net earnings totaled $18,857,721. After interest and Federal taxes there was reported net income of $5,667,176 for the January quarter, equal to $9.44 a share earned on the 600,000 shares of common stock outstanding. For the nine months the net income of $15,682,770 was equal to $26.13 a share on the common stock.

The Pressed Steel Car Co. reports for 1923 total income of $2,799,973, against $58,312 in 1922. After allowing for all charges, including depreciation, there was reported net income of $1,706,861, which, after preferred dividends, was equal to $6.65 a share on the $12,500,000 common stock outstanding. In 1922 the company reported a deficit of $341,688 before dividend payments on the preferred stock.

The Studebaker Corp. earned a net profit of $18,342,222 in 1923 after depreciation and Federal taxes. This is equivalent, after preferred dividends, to $23.60 a share earned on the $75,000,000 common stock, and compares with $18,086,195, or $23.21 a share, in 1922. The surplus after payment was $10,203,472, against $11,412,445 in the previous year.

Hayes Wheel Would Buy Three Companies

A special meeting of the stockholders of the Hayes Wheel Co. has been called for March 25 to vote upon a proposition to acquire the property of three other companies through an exchange of stock, according to a statement issued recently by C. B. Hayes, president of the company. The properties to be acquired, provided stockholders ratify the deal, are the Hayes Truck Wheel Co. of St. Johns, Mich.; Albion Bolt Co. of Albion, Mich., and the Morrison Metal Stampings Co. of Jackson, Mich. None of the companies to be taken has any mortgage or debenture debt, according to the statement.

To acquire the capital stock of the companies mentioned, according to Mr. Hayes, it is proposed to issue 7½ per cent cumulative preferred stock of the Hayes Wheel Co. for a total of approximately $1,850,000 out of a total authorized issue of $2,000,000. A letter will be sent to stockholders in which the board of directors recommends the acquisition of the properties to round out the company's expansion program.

Machine Shop Meeting In Philadelphia

A Machine-Shop Meeting under the joint auspices of the Machine-Shop Practice Division, the Engineers' Club and the Philadelphia Section of the A. S. M. E. will be held in Philadelphia on March 25. The tentative program calls for a visit to the Philadelphia Navy Yard in the morning to look over the U. S. S. *Dobbin*, a new destroyer tender. In the afternoon two papers are planned, one by Edwin J. Armstrong, of William Cramp & Sons Shipbuilding Co. on the machining of 70,000-hp. hydraulic turbines, followed by B. H. Blood, general manager of the Pratt & Whitney Co., on a subject to be announced later. J. A. Smith, chairman of the Machine Shop Practice Division, will open the afternoon session with brief remarks. After the dinner at the Engineers' Club, President Low will make a short address and the paper of the evening will then be presented by W. H. Rastall of the Department of Commerce, on Machine Tools—the Export Problem.

Durant Prepares for Greater Output

A third assembly line has been started at the Durant Motor Co. plant in Lansing, Mich., so that production will be increased from a daily output of 300 to 400 cars. Two of the assembly lines are devoted to Star cars and the third to Durants.

Hal W. Alger, vice-president of the Durant Co. of Michigan, and in charge of operations, has prepared figures to show that the total sales value of Star cars turned out during the year of 1923 was $23,000,000, and the total cost of replacements $9,000, or 16 cents each for the 55,050 cars turned out. The last open block of dealer territory served by the Lansing plant has been disposed of. There are 2,000 Durant and Star dealers between the Allegheny and Rocky mountains.

Doehler and Stinnes in Agreement

Hugo Stinnes, German financier and industrialist, has purchased the German rights for the use of the Doehler process of the Doehler Die Casting Co., New York and will use these rights through the firm of Hirch, Kupfer, and Messingwerke, which is one of the largest industrial concerns in Europe.

This purchase was effected by the son of Hugo Stinnes, who recently visited America to look over American oil properties, steel mills and other properties which it was reported Hugo Stinnes might desire to take over.

The Doehler Die Casting Co. is one of the largest producers in the world and its product is used in many lines, including automobiles, kodaks, hardware, radio appliances and electrical devices.

In addition, the company's process and products are used in a number of European countries. Through his purchase of the rights of the process Stinnes will have complete control of their future sale in Germany.

Southern Association Elect Officers

E. F. Billington, of Meridian, Miss., was elected president of the Southern Metal Trades Association for the coming year at the annual meeting held at the St. Charles Hotel, New Orleans, Feb. 26 and 27. Other officers named were: W. C. Trout, Lufkin, Tex., vice-president; J. M. Hollowell, Atlanta, treasurer, and W. E. Dunn, Jr., Atlanta, secretary.

Vice-presidents elected for the various Southern states were: W. E. Thomas, Danville, Va.; George B. Crocker, North Carolina; T. H. Siddall, Sumter, S. C.; John S. Schofield, Macon, Ga.; R. O. Collins, Tallahassee, Fla.; E. W. McDonald, Talladega, Ala.; J. A. Mosal, Jackson, Miss.; Charles R. Law, Mansfield, La.; George C. Holmgreen, Texas; F. I. Brown, Little Rock, Ark.; and T. L. Lamalta, Memphis, Tenn.

Pennsylvania Announces Equipment Buying

Railroad equipment valued at $40,000,000 will be added soon by the Pennsylvania Railroad Co., it was learned recently. Included in the new units for 1924 will be fifty of the latest type locomotives and about 12,000 new freight cars.

The locomotive order has not been officially announced, but the railroad already has instructed the Altoona shops to proceed with their construction. Work on the order was started in January and the construction will be pushed.

Inquiries for the new freight cars have been in the market for several weeks. It was understood yesterday that the distribution of the order among several companies would be announced soon.

Delivery on 475 locomotives ordered by the Pennsylvania in the past year and a half has practically been completed. This order was placed in instalments starting with the Autumn of 1922 and continuing through February, 1923. Most of the equipment was ordered with the understanding that it would be ready for service late in 1923. Due to the demand on the manufacturers, deliveries in a number of cases were held up for several months. This huge order is now in service, however, and delivery on the first of the fifty new engines is expected to start shortly.

Japan Orders Big Generator

A single unit turbine generator has been ordered from the International General Electric Co. by Mitsui & Co., for the Toho Electric Power Co. of Japan.

This G-E Curtis turbine has a capacity of 50,000 hp. and will drive a generator which will supply 35,000 kw. of electric current at 11,000 volts, enough to light 1,000,000 of the average Japanese homes. With the exception of the motor, the machine will be disassembled for shipment. The revolving field of the generator, which is twenty-seven ft. long and four ft. in diameter, will be made from a single forging and will weigh about fifty tons. This will turn at a speed of 1,800 r.p.m.

This order, including accessories and switchboard equipment, represents an initial capital expenditure of more than $1,000,000. The new unit will be located in the city of Nagoya.

Many Lists Issued by Railways

The machine tool list of the Atchison, Topeka & Santa Fe Ry. now totals more than a hundred items. It is understood that purchases will not commence for about six weeks. The Pensylvania Ry. has ordered a 7-ft. radial drill. The Chicago, Milwaukee & St. Paul Ry. list totals 44 machine tools. The Southern Ry. has asked for bids for the following machine tools: six spindle stay bolt machines; one bulldozer; one locomotive guide bar grinding machine; one locomotive piston rod grinder; one heavy duty power cold saw; two geared heavy duty lathes, 42-in. and 30-in. respectively; two 24-in. heavy duty geared head lathes; two tool room lathes, 16-in. and 12-in. respectively; two brass lathes; two 3-in. steel head turret lathes; 3-in. turret lathe; turret lathe for 7-in. box work; 34-in. turret lathe; 36-in. vertical turret lathe; 30-in. vertical turret boring mill; 54-in. standard boring mill; No. 1 plain milling machine; No. 2 universal milling machine; two 24-in. horizontal milling machines; sensitive drill press; 30-in. plain drill press; 48-in. plain radial drill press; 16-in. patent head engine lathe; two 36-in. heavy duty planers; two 32-in. heavy duty crank shapers; 3 draw cut shapers; 600 ton driving wheel press and some seventeen other similar tools.

Russians Are Buying Machinery

The Russion Soviet Government has ordered from the Westinghouse Electric & Manufacturing Co., through the Allied American Corp., five sample E-63, 1,500 watt, 110 volt, self-contained lighting and power plants. The plants will be used in the richest agricultural district in southeast Russia, to which district the Allied American Corp. has already shipped 800 Fordson tractors. This is a trial order, to be followed by another for several hundred more plants if the first are satisfactory.

The big increase in Russo-American trade which was looked for with the signing of an agreement between the Russian Foreign Trade Monopoly Bureau and the Allied American Corp. in Moscow on July 14 of last year is materializing to a degree beyond expectations.

It was learned recently that the stipulated turnover of not less than $2,400,000, fixed in that agreement with the Russian Government as the aggregate amount of business to be carried on through the Allied American Corp. each year, probably will exceed $10,000,000 by July 14 of this year when the first or "trial year" expires. As a matter of fact the $2,400,000 was reached and passed by Jan. 14, six months after the signing of the agreement.

Obituaries

EDMOND B. ROBERTS, a vice-president and secretary of Henry Disston & Sons, Inc., Philadelphia, died suddenly Feb. 22. He went with the Disston company in 1890 as an office boy and steadily worked up to the positions he held at the time of his death. He was a member of the Union League and the Manufacturers' Club of Philadelphia.

EDWARD J. MONAHAN, general superintendent of the New Haven Clock Co., New Haven, Conn., was found dead at his summer cottage at Silver Sands, East Haven, Conn., Feb. 20.

PLIMMON H. DUDLEY, an authority on railroad engineering and the inventor of many improvements in railroad operation, died recently in New York City. He was nearly 81 years of age.

PROF. JOHN G. D. MACK, state chief engineer of Wisconsin, died of heart disease on Feb. 24, at the age of 57 years. He was born in Terre Haute, Ind., on Sept. 5, 1867. He served also as chief of the mechanical department of the Railroad Commission of Wisconsin. He was a member of the American Society of Mechanical Engineers and an author of note on engineering and historical subjects.

GRAHAM MCFARLANE, of Clarksville, Tenn., one of the pioneers in the development of the iron industry in the South, died recently at Asheville, N. C., where he has recently been residing.

Personals

A. T. BARNES, president of the W. F. & John Barnes Co., Rockford, Ill., has retired from active participation in the business due to ill health. JOHN S. BARNES, secretary and treasurer, has been appointed general manager of the company to take his place. Mr. Barnes has left for Florida to spend the remainder of the winter.

GEORGE STENZEL, of Stenzel & Co., Berlin, Germany, machine tool builders, is in the United States for the purpose of securing German agencies for American machine tools. He is at the Waldorf-Astoria, New York City.

FRANK W. CURTIS, formerly sales engineer with the Haynes Stellite Co., New York City, has joined the organization of the Whitman & Barnes Manufacturing Co., Akron, Ohio, as mechanical engineer in the eastern sales division with headquarters at 99 Chambers St., New York City. Mr. Curtis is co-author with Albert A. Dowd of the *American Machinist* series, "Tool Engineering" and the books of the same title.

ARTHUR MATTISON of the Mattison Machine Co., Rockford, Ill., has been added to the board of directors of the W. F. & John Barnes Co., Rockford.

G. J. HAWKEY of the Cleveland Duplex Machinery Co., Cleveland, is the representative for the Reed-Prentice Co., Worcester, Mass., in the Cleveland territory.

THOS. H. DIETZ has been transferred to the Philadelphia branch of the Walworth Manufacturing Co., as sales engineer in charge of sales of engineering specialties.

WALTER E. DALGLEISH, who for the last twenty years has been connected with the Chase Machine Co., Cleveland, Ohio, has since the closing of the latter organization started the practice of mechanical engineering as a consultant, with offices in Cleveland.

A. C. ACER, sales manager of the Buffalo office of the Worthington Pump & Machinery Corp., is seriously ill at his home in Medina, N. Y. Mr. Acer has been in poor health for about two months, but recently had a turn for the better and his recovery is expected.

F. H. BECKER, formerly in the Eastern sales division of the Haynes Stellite Co., New York City, has been transferred to the Linde Air Products Co. of the same organization, where he will be engaged in sales development work.

P. H. SCHELL, for many years connected with the Crucible Steel Co. of America, has been appointed sales agent in the Baltimore district for the Poldi Steel Corp., New York. His headquarters are at 17 North Guilford Ave.

A. J. ROHDE has been chosen president of the Torrington Co., New York. He was formerly vice-president and general manager of the Wire Wheel Corp. of America, Buffalo, N. Y.

WALTER W. WILLIAMSON has joined the sales organization of the Chicago Belting Co., as special factory representative in the state of Texas. Mr. Williamson was formerly connected with the Briggs, Weaver Machinery & Supply Co., Dallas, Texas.

ARTHUR W. FOX, Hartford, Conn., vice-president and general manager of the Johns-Pratt Co., Hartford, has been elected vice-president and general manager of the Billings & Spencer Co. Mr. Fox will assume his new duties in March, and will continue to serve the Johns-Pratt Co. in an advisory capacity.

R. M. WILLIAMS has been appointed service engineer of the Packard Motor Car Co., Detroit, Mich.

LEE H. HAZARD has retired as production manager of the Velie Motor Corp., Moline, Ill.

JULES SOLOMON, chief engineer, RAYMOND STEIN, assistant engineer, and PAUL TRUNCHAT, body engineer, all representing the Citröen Motor Co., of Paris who are in this country inspecting the various leading automobile plants, were in Muncie, Ind., recently, and visited the plant of the Warner Gear Co. The visitors are endeavoring to gain a survey of American automobile manufacturing methods. They have visited several other Indiana cities.

A. E. WEIGEL has been appointed production manager of the Velie Motor Corp., Moline, Ill.

E. C. MEYERS has been appointed representative in the San Francisco district for the Falk Corp., Milwaukee, Wis. His headquarters are at 320 Rialto Building.

E. F. KULTCHAR, district maintenance engineer of the Chicago, Burlington & Quincy R.R., has resigned to join the Ingersoll-Rand Co., in Chicago.

JAMES W. SESSUMS has been appointed agent for the Poldi Steel Corp., New York City, in Mexico, Guatamala, Salvador, Honduras, Nicaragua, Costa Rica and Panama, with headquarters at Apartado 165, D. F. Mexico.

CHARLES C. WALSH has been appointed representative in the Detroit district for the Falk Corp., Milwaukee, Wis. His headquarters will be at 1500 Real Estate Exchange Building.

N. B. HARD has resigned as chief inspector and consulting engineer of the Velie Motors Corp. and has joined the organization of the Marion Forged Products Co., Marion, Ind.

WALTER F. DELANEY has been appointed a representative of the Hanna Engineering Works, Chicago, with headquarters in Richmond, Va.

H. R. PHILLIPS is in charge of the recently opened branch office of the Carolina Steel & Iron Co., of Greensboro, N. C., at Columbia, S. C.

CLARENCE ARMSTRONG has returned to the Stewart furnace sales division of the Chicago Flexible Shaft Co., Chicago, Ill.

LON R. SMITH has been appointed president and general manager of the Columbia Motors Co., Detroit, Mich. Mr. Smith succeeds J. G. BATERLINE, who has resigned.

Business Items

The Rich Tool Co., Chicago, has moved its plant to Detroit, Mich. Sales offices will be located in the Donovan Building, Detroit, with executive offices in the Railway Exchange, Chicago.

Manning, Maxwell & Moore, Inc., have consolidated their Cincinnati and Cleveland offices with E. H. Merrick, manager of the combined offices with headquarters in the Huron-Smith Building, Cleveland.

The Carborundum Co. will erect a new $300,000 building at Niagara Falls, N. Y.

The Western Drop Forge Co., of Marion, Ind., is the first of the numerous R. L. Dollings' subsidiary organizations to come out of the hands of a receivership, according to reports. The company has been reorganized under the name of the Marion Forged Products Co.

One of the important industrial projects for the Cleveland, Ohio, district for the immediate future is the proposed $1,000,000 construction program planned by the Hoover Suction Sweeper Co., North Canton, Ohio. The work will include the building of a factory, die plant, foundry and administration building.

The Pawling & Harnischfeger Co., Milwaukee, manufacturer of electric cranes, hoists, machine tools, shovels, etc., is the successful bidder for the entire assets of the Hercules Steel Casting Co., 871 Robinson Ave., Milwaukee, in the hands of a receiver appointed by the Milwaukee county circuit court six months ago. The property consists of a modern electric steel foundry, with a 10-ton furnace, a main building, 60x260 ft., auxiliary buildings, and full equipment. Possession was given March 1. The Pawling company will make some minor changes and operate the foundry as a unit of its works, absorbing practically the entire output for its own needs. The Hercules plant will be ready to resume production in about sixty days.

The J. E. Duff Co., Inc., has moved to 95-103 New Jersey Railroad Ave., Newark, N. J.

Krupp Interests in Spain

Fried. Krupp A-G has acquired certain metallurgical and machinery interests in Spain. Speculation was caused in France upon the announcement, but a statement emanating from the Krupp establishment in Germany is to the effect that it has simply acquired by mutual agreement an interest in the Barcelona firm the Maquinisteria Terrestre y Maritima. The project is for enlarging the scope of the company in the manufacture of locomotives, railway rolling stock, ship hulls and engines. The statement is made further that there is nothing in this shifting of base which in any way invalidates any of the clauses of the Versailles Treaty forbidding German firms to produce war material even in foreign countries.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Buffalo

There still are enough sales of single tools here and there, together with the occasional breaking of a larger order, in the Buffalo market to keep the machine tool business up to the mark and those in the industry predict that they will sell satisfactory quantities of tools for the first six months of the year at least.

One thing that has pleased the machinery men recently has been the completion of the new addition to the plant of the American Kardex Co. at Tonawanda, which will about triple the present capacity. The Kardex company is already equipping the new building with machinery, mostly power presses, power shears and power brakes and much of this business is being placed locally.

Employment in the Buffalo district is considerably lower than the figures of a year ago but the New York State Employment Bureau reports that there has been a more than usual active demand for machinists and machine and tool repair man during February. Although the automobile shops are not putting on many men, their sales departments report that orders have been coming briskly since the first of the year, particularly for motor trucks.

Cincinnati

Cincinnati machine tool houses are fairly busy at the present time. The production during the latter part of February has varied but little in volume from that during the first two weeks of the month. Manufacturers state that they believe that business during March will show some improvement.

Automobile manufacturers have been placing good business with local plants all through February, and there is no indication of a falling off in orders from this industry. The railroads are not doing much buying of large machines now, although there have been some order for cheap machines and small tools. Orders from the general industrial field are somewhat spotty with certain plants reporting good production. The Chevrolet assembly plant here has gradually increased its daily output until the capacity of the plant will be reached this week or next.

Planers have been produced in encouraging numbers in the last two weeks. Several plants devoting their efforts to planers report that their business is good at present and orders are being received in sufficient quantities to insure a satisfactory business practically throughout March. Milling machines have had fair sales while the production of lathes has held up to a good standard. Radial and upright drills have shown some improvement in sales in the last ten days.

Woodworking machinery sales are very large with plants still unable to keep up with the demand. Conveying machinery plants are also fortunately situated with orders booked months ahead, and production going along as rapidly as possible. Automobile accessory manufacturers are operating practically at plant capacity. The metal trades have increased their production slightly in the past week and are operating better than they have at any time this year.

Chicago

Inquiries for machine tools and machinery are being maintained at a fair volume and purchases are expected shortly. Sales for February show a decided increase over January. Industrial buying has shown a decided improvement during the past two weeks. Industrial sales are scattered and mostly of small equipment of single machines. Sales of used equipment, particularly from industrial plants that have discontinued operation, continue to play an important part in the market. Some two hundred machine tools were sold at Moline, Ill., recently.

Wilson & Co., Chicago, meat packers, have issued an inquiry for two engine lathes, a milling machine, two pipe machines, a shaper, a hack saw, an upright drilling machine and an emery stand to replace machinery damaged in a recent fire. The Pullman Co. has ordered a 7½-ton electric traveling crane for use at Michigan City, Ind., from the Shaw Electric Crane Co., and has also purchased two axle lathes and three car wheel borers. The National Plate Glass Co. is reported to have commenced purchase of tools.

Philadelphia

Machine tool manufacturers in the Philadelphia district continue to view the industrial situation with a hopeful attitude. The business transacted in February was characterized as good with prospects of another good month in March.

One of the largest producers in Philadelphia was pleased with the fact that the orders received in recent weeks came from a wide area over the country, indicating a generally healthful condition. Indications are for a good year, it was said.

Producers of smaller tools reported a decided increase in orders. The railroads have made some purchases, and an increase in this branch of the trade is anticipated.

Dynamo and motor dealers are looking forward to an active spring. Replacements and repair jobs have occupied their attention during the dull season. Machine shops and laundries have been purchasers of 20-hp motors, but installations in the large plants are anticipated soon. Prices are firm.

Detroit

Preparations to meet the greatest spring demand in the automobile's history has created in Detroit and its environs a sharp increase in competition, featured by the increase in prices announced during the past two or three weeks by seven concerns.

Machine tool manufacturers and representatives assert that the outlook for the industry during the next few months is extremely bright. A tendency is noted that the smaller dealers are experiencing more or less difficulty in keeping their heads above water. This condition is not universal among the smaller machine tool handlers, but is more wide-spread than usual.

Building is continuing to break all records, and there appears every possibility that 1924 will witness an even greater building program than last year. Bank clearances, railroad car loadings, and employment figures indicate a very general prosperity for this section.

Cleveland

The close of February finds the machine tool manufacturer and distributor in the Cleveland district in that same optimistic vein he manifested at the beginning of the year, with this difference—there is less to base that optimism upon than there was eight weeks ago. Throughout February there has been a steady diminution in orders from consumers of both the heavier varieties of machine tools, and from those supposedly in need of lighter equipment.

Probably the most encouraging phase with the turn of the year into the first spring month is the apparently increasing need of building industry operators for heavier equipment. Foremost in the new business booked by punch and shear producers here is the demand from structural steel factors. In this connection cranes and similar equipment are finding equal interest with the building industry and supply interests.

Demands from automotive industries for new equipment is not up to expectations. In fact the inroads of second hand equipment of this character still are in evidence.

In the last week or so planers, of the open side variety, appear to be the most active item on the list. These are finding their way to established automobile manufacturers in a fair way, but more so to general purpose machine shops.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
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IF THERE were any way of appraising mathematically the value of news, last week's budget would show a substantial balance to the good. The most important entry would be the progress that the Dawes Committee has made toward the completion of a workable plan for the settlement of the reparation question.

Space limitations make a detailed description of the proposal impossible, but its practicability hinges upon the fact that Germany's internal debt being payable in paper marks, was practically wiped out when the mark became worthless. This is true of her private as well as her public debt. Therefore her physical assets being now unencumbered are available as security for a loan that will provide the working capital required for her rehabilitation, and her taxes being unnecessary for the service of her "evaporated" debt, can be used to amortize and pay interest on the "reparation bonds" for which the Dawes scheme provides.

A cable from Andre Tardieu predicted an acceptance of the plan because "the English are tired of unemployment, the French of financial difficulties, the Germans of multiform bankruptcy, and the Americans of European anarchy." My own private advices confirm this view and, as coming events cast their shadows before, I expect that from now on the anticipation of economic peace in Europe will operate as a stimulant to international trade.

The franc dropped back to 4.09 last Thursday upon the defeat of a Belgian ministry that was closely in sympathy with France, but there was a prompt recovery and it is evident that the French people are now in a mood to insist that some method shall be found to prevent further depreciation in the gold value of the rentes in which most of the nation's savings are invested.

I stress the importance of the foreign news for, although domestic conditions in the United States are in the main satisfactory, it is becoming daily plainer that a better export demand for our products is desirable. That this is particularly true of copper is indicated by the passage of the Anaconda dividend as well as by the predicament of the Virginia-Carolina Chemical Co., whose losses are largely due to the reduction in the export demand for cotton seed oil. But despite the decline in the securities of these two companies the stock market has been otherwise firm and the railroad shares are higher on the announcement that the Pennsylvania Railroad will apply for permission to include the Norfolk & Western in its system. This is regarded as a harbinger of similar action by other important railway systems and as the impetus of what is an inevitable movement increases the strategic value of many inactive railway stocks will be made apparent.

What's Doing in Industry

Machinery and machine tool business in February was as good as during the month of January and in some parts of the country—notably New York, Cincinnati and Detroit—it was better than during February of last year. In almost all parts of the country business was good and the predictions are for steady improvement for at least another month while the more optimistic prophets look for extended activity during the entire first half of the year. Railroad inquiries are numerous with buying slightly off from this source; the automobile builders have been good customers. General industrials are commencing to buy and further improvement is expected.

In the electrical industry business is in the best condition since the war with no signs of a let-down for at least two months.

Iron, steel and minor metals are all in demand with the supply adequate.

European situations seem to be clearing and the world is looking for industrial activity across the water soon.

Political troubles do not seem to be industrial troubles anymore, and the busy manufacturer, while horrified by the oil disclosures, does not shut down his factory in order to discuss them.

The scandal mill at Washington continues to turn out its daily grist of rumor and innuendo, but the public mind has become somewhat indurated and is no longer depressed by it, although the talk of a third party candidate persists in the newspapers. But much may happen before the election, and meantime there are 110,000,000 people in the country to be fed, clothed and housed.

The mere work of providing for them furnishes an enormous business that will give employment to every one as long as it proceeds without interruption.

That it is so proceeding is indicated by the commodity markets, which seem to have entirely recovered from their alarm over the political developments.

Cotton futures have recovered their poise after an extreme decline of nine cents a pound from the top for the season. The statistical experts are in a bitter fight about the size of the carryover. If the mills could spin figures there would be no famine, but the supply of cotton itself is very meagre and unless every bale in existence is marketed by July 31 a considerable reduction in the normal consumption seems inevitable. The greatest scarcity will probably be felt in September and October for the season is late in Texas and the decline in the market has made farmers less eager to increase their acreage. A decrease is in fact now predicted by many.

The steel industry continues well employed and the non-ferrous metals are in good demand although copper is a little lower on the passing of the Anaconda dividend.

Railroad traffic continues large and the new building planned exceeds last year.

The $10,000,000 corporation organized at President Coolidge's suggestion for the relief of the banks in North Dakota and Montana is in working order and is giving help where it is deserved.

The weekly statement of the Federal Reserve System shows a slight increase in deposits and earning assets. The result is a slight decline in the reserve ratio which stands at 80.6 per cent. But as the total of rediscounts now amounts to only $531,000,000 and the member banks seem well able to take care of their customers from within their own resources the Federal Reserve figures are becoming unimportant.

And finally there seems to be some hope that a compromise measure of tax reduction will be agreed upon in the House and accepted by the Senate. It is too early to speak confidently of its details, but if and when it is passed another irritating factor will be eliminated and the way made clearer for a year of comparative placidity in business.

What Is England's Industrial Future?

The new government and its relation to business—Overcoming competition in the export field—Hopes brighten as trading gains

By Our London Correspondent

THE recognition by the new government of Soviet Russia—partial though it may be—shows which way the wind is blowing, and the attempt to get on more friendly and more effective terms with France is another manifestation of the recognition that the all-important problem in Great Britain is the material reduction and, if possible, the elimination of unemployment. In a measure, greater than any other country Great Britain depends for anything like prosperity on her overseas trading, and maintenance of the undoubtedly higher standard of living brought about by war conditions, makes increased overseas trading still more a necessity. The workers of the country have no intention of parting with any advance they managed to secure during the war period and in this lies much of the current labor unrest.

We are constantly being told of the need for reduction in the cost of production. But production problems, depending as they do in a large measure on the use of improved machinery, are much more easily solved than the problems of distribution, that are more directly controlled by human beings who have the power to combine either openly, as in the case of ordinary employed persons, or in more subterranean manners by others.

Time and again it has been stated that if the present high production costs and prices could be reduced Great Britain could compete on more level terms with other countries. It is a truism intended to disguise what has been openly asserted by some leaders of industry, namely, that reductions in wage rates are necessary. Many workpeople are superfluous in existing conditions and are likely to remain so until the old notion of small profits and quick returns becomes once more effective.

Relations with France

The need for a better understanding with France has been clear for two or three years. The last two governments merely let matters slide. What the new government will do remains to be seen, but from the point of view of British trading, its methods can hardly be less successful than those of its predecessors.

Last year the imports received by Great Britain were valued at about 1,098 million pounds, while the exports of goods produced in Great Britain reached about 767⅛ million pounds, and the re-exports, i.e., exports of foreign and colonial merchandise, were valued at about 118¾ million pounds. These figures suggest a definite advance on the last two years. If quantities are considered it is probable that the increase is greater than appears from the declared values, for, according to official computations, the average values of imports declined during the year by about 2 per cent, and those of British exports by something like 5 per cent, the relatively small re-exports, however, showing an increase in average value of about 7 per cent. The result is that in all probability the quantities of imports, and also of British-produced exports, increased during the year by about 11 per cent, the rise in re-exports being between 6 per cent and 7 per cent.

Export Values

A feature of the exports is the increase in average value and still more in the quantities of coal shipped. Manufactured goods exported were generally lower in average value, the vehicle group showing a reduction of more than 25 per cent and machinery, 20 per cent. On the other hand, the last class expanded in volume by about 8 per cent, iron and steel goods by 30 per cent and electrical goods by nearly 50 per cent, whereas imported vehicles declined in volume by about 25 per cent, this being due to the depressed condition of shipbuilding.

An additional difficulty has been experienced this year in making comparisons of overseas trading owing to the existence of the Irish Free State. This is, of course, for such purposes now regarded as a foreign country. The effect is to increase the apparent overseas trading, the preliminary estimate being that imports have been increased by about 25 million pounds, British-produced exports by about 20 million pounds, and re-exports by about 6 million pounds. Allowing for this, as compared with pre-war figures total money values both of imports and of exports of British produce last year appear to have been higher by about 40 per cent, while re-exports were higher by about 3 per cent.

The figures show an obvious excess of import values as compared with total export values. When bullion is brought into account, the difference last year was about 203 million pounds. On the other hand, our total invisible exports were estimated to be worth about 300 million pounds, leaving a balance available for investment overseas of 97 million pounds. The items in invisible exports include commissions, 30 million pounds; shipping, 110 millions; and income from overseas investments, 200 million (the last an estimate severely criticised), less 50 millions paid off the debt to the United States.

Regarding the debt, however, the effects of recent changes in the rate of exchange have been somewhat startling, and it has been possible to show that on the sterling basis at a given moment we actually owed America more than a year ago, even after allowing for the payments made.

The European edition of this journal has obtained from the Board of Trade returns relating to overseas trading in metal-working machine tools, from which it appears that Great Britain exported last year £1,506,874 worth of these tools weighing 14,126 tons, while we imported tools to the value of £499,852 weighing 3,822 tons, re-exported machine tools being valued at £46,594 and weighing 192 tons. In addition, in a class known as engineers' tools, including milling cutters, stocks and dies, drills, wrenches, spanners, etc., but excluding gages, exports were valued at £516,328, imports at £470,156 and re-exports £39,577.

The exports show a definite increase in weight in the year, but some decrease in total value, while the imports also show an increase in weight for the year with a higher increase in total value. In any case, the weights whether of imports or exports are not very different from pre-war figures, but the value per ton has definitely increased. The figures give no support for the contention that unusually large quantities of machine tools are being brought in and still less support for the contention that prices are unfair. Actually the average value per ton of exported tools of British production showed a decline in the year from £126 to £106, while the average value per ton of the imports rose from £125 to £131.

The Machine Tool Business

Several sections of the machine tool industry are again taking a hopeful view of the situation, and at last one of the railway companies has during the last week or so placed orders of considerable value, though the exact amount cannot be ascertained. The total value exceeds one-third of a million pounds but not all of this is for machinery and machine tools.

One of the newer developments is in connection with the grinding of the treads of wheels, more than one new machine or special appliance having recently been designed for that purpose. The process was tried a number of years ago, but so far has not received extended application.

Returning to the general situation, it is felt that in foreign affairs the new government has made a good, even an auspicious, start. The real test may be in its manner of dealing with home affairs. We have recently been through another railway strike and, although it certainly did damage—the registered unemployed rose during one week by 69,000—the ill effects were minimized by the fact that the two chief trade unions concerned were in opposition.

Germany Needs American Machinery

The up-hill climb to economic restoration—Letting down the bars on imports—German representatives are re-appearing

By Our Berlin Correspondent

GERMANY'S return to pre-war conditions, initiated by the readjustment of labor conditions, is widening out into a broad avenue, engulfing the problem in all its ramifications. Labor now being ousted from its advanced position, a number of other matters are being tackled, foremost among them, the country's future foreign trade relations. For some years German industry has enjoyed a unique position with regard to export, which allowed every manufacturer to partake in the export "game" and do it at extremely advantageous terms. Owing to export control no underbidding was feared. The industrial associations, in which export control was vested, saw to that and took care that the minimum of prices which they fixed was profitable to all. By assuming also the functions of a committee of surveillance of domestic prices, they provided manufacturers with an equally effective protection in the home market. With regard to imports, the latter's position was even more secure. The double wall of embargoes and adverse exchange kept German frontiers closed almost hermetically and hardly a draft penetrating from the outside has disturbed the restfulness reigning within.

A fundamental change is now impending. Export control is being abolished step by step in quick succession. This seems to be done in compliance with industry's wishes and in response to the severe criticism to which it was subjected from all sides during its lifetime.

Decontrol Now the Rule

On close observation it is seen that not all of the manufacturers are in favor of decontrol. Being quite aware that it means restoration of free competition abroad and at home, there is quite a multitude of them who would rather have seen it perpetuated if circumstances would permit it. They are only bending to the inevitable. Decontrol of exports was advocated only by the large industrial firms that have nothing to lose by competition but everything to gain. The huge organization built up for control is now being dismantled. In a few months the whole structure will have disappeared and free exports will have been restored.

The new situation thus inaugurated differs in so many respects from previous conditions that it calls for a rather extensive re-adjustment. Manufacturers who have become used to having the sales end of their business attended to from the desk, will now have to stir. Contacts with the outside world that have been kept up leisurely or not at all will have to be resumed. Agents and traveling engineers that have almost become extinct will have to be employed again and dealers will again get their rights. If manufacturers want to profit by the fluctuations of the market, they will have to get in touch with its pulsation. In practice, export control meant the existence of many syndicates holding arbitrary power over prices. These syndicates have now come to an end. The consequences to the movement of prices are obvious. Until now it has made its appearance only to a slight extent, doubtlessly checked by the fact that manufacturers are entirely ignorant of what figure their products would constitute rock bottom prices. This ignorance may impart, however, quite bizarre dimensions to an underbidding movement if such is once started.

> "The belief has become common property that Germany needs no import of manufactured goods; that what other countries may be able to offer may be had in Germany. There are some men left in the country who are of a different opinion, however, and adhere to the theory that imports are needed as a regulating factor and, in a country of highly developed industry largely dependent upon export, manufacturers must be able to hold their own against it."

More important to industry is the import problem which is again slowly coming into the foreground. There is no doubt that many manufacturers have lost sight of it and have entirely forgotten to count it among possibilities. The belief has become common property that Germany needs no import of manufactured goods; that what other countries may be able to offer can be had in Germany. There are some men left in the country who are of a different opinion, however, and adhere to the theory that imports are needed as a regulating factor and, in a country of highly developed industry largely dependent on export, manufacturers must be able to hold their own against it. Moreover, it is quite evident that the last decade of isolation during which German engineers, previously accustomed to going all over the globe—picking up new ideas and keeping informed of what "the other fellow" was doing—were more or less bottled up in their own country. More pronounced and more important still is the lack of initiative towards progressive ideas. The German industrialist, formerly the quickest to act on a new creative idea, has become slow and conservative. The causes of this retrograde evolution are manifold.

Precaution in the face of an uncertain future and lack of liquid means usually serve as the explanations. To these must be added a largely accumulated amount of self-sufficiency and exalted ideas of perfection already achieved. If German industry is to be roused from the lethargy which is holding under its spell shop practice, sales management and designing ideas, a strong spurt is needed. Free export alone cannot supply it. Free import is equally essential—perhaps more so.

Such thoughts have probably governed the advisers of the government and have decided the latter to gradually break down the protective wall of import embargoes. One of the most momentous developments of recent months is the slow but steady encroachment of free import upon the sacred precincts of manufactured articles. An invisible hand is evidently directing the fate in industry from a higher conception of its needs.

It is being announced that the import restrictions will gradually be withdrawn as seems advisable, taking due regard to the present precarious position of industry. A fair start has already been made and a number of manufactured articles, among them some of the machine tools, put on the free list. A further extensive list is to follow shortly. If the official intentions are interpreted correctly, the free list will in a few months encompass all lines of machine tools.

The adverse exchange is already a matter of the past, at least for the time being, with justified hopes of a permanency. There remains only the present shortage of liquid means and the price question. Regarding the former, there is no doubt that a gold foundation of the present currency such as is now proposed would immediately relieve it. The stock of even the proudest of German industrial enterprises is greatly undervalued. If confidence in the German currency is restored, it is bound to attract capital from outside, which will free industry from its cramped position.

German Prices

The price problem is an entirely open question. It is quite likely that German prices can be kept below world prices, but not nearly at the ratio of the past years. Quality and higher efficiency will probably be able to bridge the difference of prices.

Among the classes of machinery put on the free list since Jan. 4, 1924, are machine tools and woodworking machinery. Such machines can now be imported without any formalities.

Efforts will probably be made in the near future by German dealers to get in communication with American manufacturers with a view of taking up old-time business relations or of establishing new ones.

The price of German tools is now

keeping at approximately 20 per cent to 30 per cent above pre-war prices. This price is not built upon accurate cost calculation, but rather upon a tentative market price. If German manufacturers figure on cost they might possibly find it too low. If that is so, they will try to cut down wages. It will take many months until prices are stabilized and even longer until manufacturers know the lowest prices that the efficiency of their plants, their workmen and economy of production will yield.

Such conditions promise an effective competition against foreign standard tools. On the other hand, single-purpose tools and all others that are not being built in Germany should have a fair market.

The huge German metal-working industry needs the most efficient machinery to be had if it is to hold its own in the enormous up-hill struggle ahead of it. It will be up to American manufacturers to show that their tools have advanced ahead of German makes. The German market is yet in its first delicate state of recovery from a long illness, but there are fair chances that it will progress swiftly, especially if the international plans now being contemplated materialize. A test would perhaps prove that it is already more receptive than is commonly supposed.

French Artisans Oppose Special Apprentices

At the Paris convention, the French Chamber of Artisans opposed the forming of apprentices in various industries, of which the most important are perhaps the metal workers. The desire was not for the specialized workman, but the complete workman. Big industry needed the specialist; the artisans needed competent all-round workers, it was claimed.

It was deemed that at this time when France was actually undergoing a short-gage of competent labor, it was preferrable that the young idea should be taught a complete trade. A further statement was made that the association was not opposed to progress in the exercise of individual professions where specialist skill was desirable, but that various educational elements should be brought into play whereby all workers in whatever trade should have a general knowledge of that trade as well as a more refined knowledge of their specialty.

England Wants Heavy Machinery

There should be a good demand for American hoisting and excavating machinery in Great Britain if it were properly introduced, writes Consul Eliot B. Coulter, of London, to the Department of Commerce. While at present it is only occasionally that any particular firm is in the market to purchase this class of machinery, a live agent with an advertising campaign to back him up should create a considerable demand.

Herr Thyssen Talks on America

In an interview given to the French "Journal des Debats," Herr Fritz Thyssen says that it is not right that America should expect the allies to pay their war debts, also that: "Europe is declining; while we quarrel the United States is becoming stronger and stronger. Henry Ford is making more than enough money to pay the reparations total. The United States produces forty million tons of steel a year and when she dumps five per cent of this total into Europe our market will be wrecked. Unless the governments of Europe realize and understand and untangle their quarrels at an early period we run the risk of falling into slavery."

Motor Accessory Sales Record

Sales of motor car accessories in January were $51,028,000, the largest monthly total on record, according to figures compiled by the Motor and Accessory Manufacturing Association. This total compares with sales of $43,289,950 in December and $45,451,950 in January, 1923. About 300 manufacturers hold membership in the association and report their monthly sales.

Trade Catalogs

Screw Thread Comparator. The Jones & Lamson Machine Co., Springfield, Vt. An exceptionally novel and interesting booklet has been published by this company describing the Hartness Comparator. In the introductory remarks it states that the booklet marks the birth and christening of a pair of twins, two new symbols for the phrasing of an engineering formula. These symbols are two little figures with high gnome hats, one marked "J," while the other bears the letter "L" denoting Jones and Lamson. They are similar to the Brownies made famous some years ago. In a very effective manner they are made to point the virtues of the comparator. The booklet is excellently printed and illustrated, and contains valuable information forcefully told.

Mult-Au-Matics. The Bullard Machine Tool Co., Bridgeport, Conn. Actual performances of this machine are recorded in this booklet that has just been issued. Diagrams show the various work that can be done by the mammoth machine and how the cost of production can materially be decreased by its use.

Air Compressors. The Champion Pneumatic Machinery Co., Chicago, Ill. Air compressors for service stations, garages, tire shops and various industrial requirements are illustrated and described in this catalog. Specifications in each instance are given as well as suggestions as to use.

Pamphlets Received

Employment in Selected Industries. U. S. Department of Labor. Government Printing Office, Washington, D. C. The January report on the above listed topic has been published.

Observations, Obstinate and Otherwise. By Harvey Higgins, Jr., 6700 Central Ave., Cleveland, Ohio. Mr. Higgins, who is the advertising manager of the Standard Tool Co., has gathered together in this little booklet many pertinent thoughts on the follies and weaknesses of man as well as the good points to be found in the same animal. Gentle digs at some of the existing conditions of business tempered with logic are included in the booklet. It is worthy of perusal and is short enough to send home those thoughts that Mr. Higgins thinks of value.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machine tools, including lathes and milling, drilling and shaping machines. Birmingham, England. Agency. Reference No. 9175.

Tools such as hand drills, cutters and mill gearing. Birmingham, England. Agency. Reference No. 9175.

Machine tools, labor saving machinery and machine specialties. Vienna, Austria. Agency. Reference No. 9229.

Engineering machinery. Sydney, Australia. Agency. Reference No. 9237.

Engines, lathes, planers, drills and power hammers. Delhi, India. Purchase and agency. Reference No. 9285.

Precision tools. Vienna, Austria. Agency. Reference No. 9229.

Forthcoming Meetings

The Lyons Fair. Lyons, France. March 3 to 17, 1924. Information furnished by Emile Garden, 50 Church St., New York City.

National Metal Trades Association. Twenty-sixth annual convention. Hotel Astor, New York City, April 23 and 24. L. W. Fischer, National Secretary, Peoples Gas Building, Chicago, Ill.

American Gear Manufacturers Association. Spring Meeting, April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 26, 27, 28 and 29. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

National Association of Purchasing Agents. Annual Convention, Mechanics Hall, Boston, May 20, 21, 22 and 23. W. L. Chandler, secretary, 19 Park Place, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer 1,315 Spruce St., Philadelphia, Pa.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4,600 Prospect Ave., Cleveland, Ohio.

New and Enlarged Shops

Machine Tools Wanted

Calif., Los Angeles—Atchison, Topeka & Santa Fe Ry., Kerchkoff Bldg., W. M. Catlin, Purch. Agt.—machinery for proposed shops at Richmond.

Mass., Boston—City, c/o T. P. Glynn, School House Dept., City Hall—machinery and tools for proposed machine and woodworking shops of $2,500,000 school at Roxbury.

Mass., Gardner — Collier-Keyworth Co. (manufacturer of baby carriages, etc.)—two No. 1 Bliss presses (Stiles pattern).

N. Y., Watertown—Sage Economy Radiator, Inc., Water St., H. W. Ackerman, Treas.—special sheet metal working machinery for the manufacture of brass heating radiators.

N. Y., Woodhaven (Branch of Jamaica)—Cusciloid Co., 2147 Woodhaven Ave. (manufacturer of celluloid novelties), A. Lefkowitz, Purch. Agt.—Seneca Falls quick change lathe.

Pa., Waynesboro—Frick Co. (manufacturer of ice machines)—heavy duty Ajax upsetting forging machine No. 3

Wis., Arcadia—Trempleau Co. Machine & Repair Wks., J. A. Hess, Mgr.—grinding machine, turning lathe, welding machine and other shop equipment to replace fire loss.

Wis., La Crosse—Accessories Production Co., c/o J. Holley, 2110 Kane St. (manufacturer of automobile signal lights)—emery grinder, drill presses and lathe.

Wis., Milwaukee—Central Bd. Purchases, City Hall—pipe threading machine, 4 in.

Ont., Niagara Falls — Niagara Wire Weaving Co., Ltd. (manufacturer of paper machine wire cloth, etc.), E. J. Buell, Mgr.—one milling machine, either planer or Universal type.

Machinery Wanted

Ala., Florence—Office of United States Engineer—electric traveling cranes.

D. C. Wash.—Southern R.R. Co., Southern Bldg., C. R. Craig, Genl. Purch. Agt.—electric overhead crane for new shops at Birmingham.

Ia., Muscatine — Tangley Co. — plating dynamo and other equipment, would consider purchase of small plant.

Ky., Louisville—Office of United States Engineer, P. O. Box 72—one single stage air compressor, capacity 110 cu.ft. per min. at pressure of 100 lb., for Dam 44, Ohio River, Leavenworth, Ind.

Mich., Detroit — Mazer Cigar Co., 5041 Grandy Ave.—complete cigar making equipment for proposed $100,000 factory.

Mich., Northville—Bd. Supervs., Wayne Co. Bldg., W. H. Green, Jr., Secy.—laundry machinery and ash handling equipment for proposed $500,000 training school.

N. C., Rocky Mount—T. T. Horne, Mayor, and Bd. Aldermen—receiving bids until Mar. 26 for one 30 ton turbine room crane with motor hoist, 30 ft. span with rails, track girders, etc.

O., Portsmouth—Kah-Patterson Printing Co.—special equipment for proposed $60,000 plant.

Tex., Corsicana—Bd. Educ.—receiving bids until Mar. 10 for medium size bandsaws, lathes, scroll saws and other woodworking equipment for manual training department of high school.

Wis., Appleton—Scolding Lock Hairpin Co., 844 College St., E. H. Krug, Mgr.—wire forming machinery and japanning equipment.

Wis., Green Bay—Joannes Bros. Co., 118 South Washington Ave.—monorail conveyors and equipment, also refrigeration machinery for new warehouse.

Wis., Milwaukee—E. F. Baumann Shoe Co., 981 Booth St.—vamping machine, laster, one eyelet and one stamping machine.

Wis., Milwaukee—Pawling & Harnischfeger Co., 38th and National Aves. (manufacturer of cranes, etc.), H. Harnischfeger, Purch. Agt.—foundry equipment, molding machines, dippers, etc.

Wis., Milwaukee — C. Schreiner, 1789 Port Washington Ave. (garage)—oil extractor, air compressor, gasoline tanks and pumps.

Wis., Sheboygan—Press Publishing Co., 702 Center Ave.—presses, typesetting machines, etc., for new printing plant.

Que., Lachine — J. A. Dragon, 221 St. Joseph St.—one side moulder, also sash and door clamp.

Que., Montreal — P. Belanger, 79 St. George St.—combination free air outfit, triplex chain hoist, small lathe and gas tank for garage.

Que., Montreal—French Chemical Products Co., 65 Carriere St.—one bread mixer, 200 lb. capacity.

Que., St. Isidore d'Auckland—L. Mercier—saw table and drum sander for sawmill.

Que., St. Lambert—Dupuis Freres, Victoria Ave.—complete equipment for sash and door factory.

Que., Scotstown—Scotstown Sawmill Co., Ltd., J. W. Taylor, Purch. Agt.—resaw, rip saw and bandsaw.

Que., Victoriaville — Langlois & Gouin (sash and door factory)—saw sharpener and moulder.

Metal Working Shops

Calif., Fullerton — The Western Glass Co., Streator, Ill., awarded the contract for the construction of a factory, including administration building, casting and furnace buildings, machine shop, warehouses, etc., here. Cost between $300,000 and $500,000.

Calif., Los Angeles—The Atchison, Topeka & Sante Fe Ry., 6th and Main Sts., is having preliminary palns prepared for the construction of a 6 story, 115 x 375 ft. factory on Imperial and 6th Sts. W. J. Saunders, Laughlin Bldg., Archt. California Truck Co., 322 East 3rd St., lessee.

Calif., Los Angeles—G. L. Orccuo, c/o Austin Co. of California, Contrs., Bartlett Bldg., awarded the contract for the construction of a 1 story, 50 x 100 ft. bed spring factory on 60th St.

Calif., Los Angeles — The Pan-Amer. Petroleum Co., 1015 Security Bldg., awarded the contract for the construction of a 1 story, 32 x 142 ft. garage and machine shop on East Washington St.

Calif., Los Angeles—The Safety Electric Products Co., 1330 East 16th St., will build a 1 story, 95 x 250 ft. factory.

Calif., Oakland—The Hoyt Heater Co. and Marchant Fdry. Co., Powell and Landegran Sts., are having plans prepared for the construction of a 1 story factory and foundry on 10th and High Sts. Ruggles & McKee, 1429 Bway., Engrs. Noted Feb. 14.

Calif., Richmond—The Atchison, Topeka & Santa Fe Ry., Kerchkoff Bldg., Los Angeles, is having plans prepared for the construction of shops, etc., here. Cost will exceed $150,000. R. B. Ball, Ch. Engr. Coast Lines.

Calif., San Francisco—The Fisher-Gaffney Body Co., 555 Bryant St., plans to build a 2 story, 115 x 150 ft. factory for the manufacture of automobile bodies.

Calif., San Francisco—The Kleiber Co., Inc., 1480 Folsom St., plans to build a 2 story, 125 x 300 ft. plant for the manufacture of trucks and automobiles on Howard and 10th Sts.

Calif., San Francisco—L. R. Lurie, 315 Montgomery St., plans to build a 10 to 12 story, 155 x 300 ft. garage on 4th St., Jessie to Stevenson St. Estimated cost $1,500,000. Engineer or architect not selected. O'Brien Bros., Inc., Archts., 315 Montgomery St., prepared preliminary plans.

Ill., Chicago—The Morden Frog & Crossing Wks., 208 South La Salle St., plans to build a 100 x 240 ft. addition to main building. Estimated cost $100,000. J. Karcher, Secy.

Ill., Galesburg—The Chicago, Burlington & Quincy R.R., 547 West Jackson Blvd., Chicago, plans to build a car plant, here. Estimated cost $200,000. A. W. Newton, Ch. Engr.

Ind., Noblesville—The New Process Steel Co. plans to build two additional units to its plant. Cost will exceed $40,000.

Ind., Valparaiso—The Pennsylvania R.R. Co., Broad St. Sta., Phila., Pa., plans to rebuild its roundhouse and shop, which was recently destroyed by fire, here. Estimated cost $40,000. H. R. Leonard, Ch. Engr. Bridges and Bldgs.

Kan., Galena—The M. Robeson Lumber Co. will soon receive bids for the construction of a 1 story, 48 x 90 ft. machine shop at 209 Main St. R. L. Patterson, Galena, Archt. Galena Machine & Electric Co., lessee, F. W. Speck, Mgr.

Kan., Wichita — The Hayes Equipment Co., 701 East Gilbert St., awarded the contract for the construction of a 1 story, 100 x 229 ft. pump factory.

Ky., Louisville—The Louisville Gas & Electric Co., 321 West Chestnut St., is having plans prepared for the construction of a 3 story, 175 x 175 ft. service station, workshop, etc., on 7th St. and Ormsby Ave. Estimated cost $250,000. Byllesly Eng. & Management Corp., 208 South La Salle St., Chicago, Engrs. Noted Nov. 8.

Ky., Louisville—Summers-Herrman, Inc., 905 3rd St., will receive bids until Mar. 17 for the construction of a 3 story, 90 x 100 ft. garage on 3rd and Breckinridge Sts. Estimated cost $150,000. D. X. Murphy & Bro., Louisville Trust Bldg., Archts. Noted June 14.

Mass., Boston—The New England Iron Wks., Summer St., awarded the contract for the construction of a 1 story, 130 x 180 ft. addition to foundry and shop. Estimated cost $100,000.

Mass., Brighton (Boston P. O.) — The Mack Motor Truck Co., 195 Massachusetts Ave., Cambridge, awarded the contract for the construction of a 2 story, 150 x 160 ft. garage with 33 x 160 ft. ell on North Beacon and Arthur Sts., here. Estimated cost $200,000.

Mass., New Bedford—C. L. Hathaway, 25 Elm St., manufacturer of gasoline engines, will build a 1 story, 50 x 100 ft. addition to machine shop and foundry. Estimated cost $25,000.

Mass., Roxbury (Boston P. O.) — The City of Boston, c/o T. P. Glynn, School House Dept., City Hall, is having plans prepared for the construction of a 3 story high school and library, including machine shop, etc., on Townsend St. Estimated cost $2,500,000. H. H. Atwood, 61 Alban St., Dorchester (Boston P. O.), Archt.

Mich., Detroit—E. R. Cain, 2128 Penobscot Bldg., awarded the contract for the construction of a 4 story, 92 x 145 ft. garage and sales building on Cass Ave. and York St. Olds Motor Car Co., 7 Sproat St., lessee.

Mich., River Rouge—The Ford Motor Co., Highland Park (Detroit P. O.), is having plans prepared for the construction of a 1 story, 270 x 1,260 ft. spring factory and upset building, here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Minn., Minneapolis—The Juckem Co., 215 8th St. S., awarded the contract for the construction of a 2 story, 60 x 132 ft. garage and factory for the manufacture of automobile bodies at 217 9th St. S. Estimated cost $45,000. E. J. Juckem, Pres. Noted Feb. 7.

Mo., St. Louis—The Brock Eng. Corp., 698 Arcade Bldg., is having plans prepared for the construction of a 200 x 250 ft. assembly plant for feed water purifiers and steam boilers. Estimated cost $30,000. E. J. Brock, Pres. Private plans.

Mo., St. Louis—The Haynes-Langenberg Mfg. Co., 4525 North Euclid Ave., will build a 1 story, 110 x 160 ft. furnace factory on Euclid Ave. and Kingshighway, N. E. Estimated cost $40,000.

Mo., St. Louis—The Von Hoffman Realty & Investment Co., 109 South 9th St., awarded the contract for the construction of a 2 story garage on 9th St. Estimated cost $200,000. Down-Town Garage Co., c/o O. J. McCawley, 613 Chestnut St., lessee.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron sales tapering off. Steel ingot production exceeding pig-iron output. Buyers turning attention in direction of foreign iron. No. 2 f'd'y firm at $23@$24 per ton, Birmingham. Steel plate market stronger in tone; fair demand for railroad material and ship plates; price steady at $2.50 per 100 lb., Pittsburgh. Buying of steel shapes more active; most quotations at $2.50 per 100 lb., Pittsburgh, with exceptional tonnages reported at $2.40. Bars, firm at $2.40. Steel sheets and tin plates leading all other steel items in volume of orders placed.

Advances—General trend of non-ferrous metals upward. Copper advancing; demand heavy; production slowing down. Lead market rising rapidly; price, 1¼c. per lb. above Feb. 21; tin up 1c. Zinc none too firm; price, however, is 2½c. per 100 lb. above Feb. 21 level. White lead and oxides, f.o.b. New York, advanced ¼c. per lb., Feb. 28, from price lists of Feb. 21; rise due to increased cost of pig metal. Solder (½ and ½) up 4¾c. per lb. in Cleveland.

No declines reported.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	23@24
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	3.00	4.34	3.75	4.00
No. 12	3.10	4.39	3.80	4.05
No. 14	3.20	4.44	3.85	4.10
No. 16	3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.65	4.45	4.70
Nos. 22 and 24	3.75	4.70	4.50	4.70
Nos. 25 and 26	3.80	4.75	4.55	4.75
No. 28	3.85	4.85	4.65	4.85
Galvanized				
Nos. 10 and 11	4.00	4.90	4.70	4.85
Nos. 12 and 14	4.10	5.00	4.80	4.95
Nos. 17 and 21	4.40	5.30	5.10	5.24
Nos. 22 and 24	4.55	5.45	5.25	5.40
No. 26	4.70	5.55	5.50	5.55
No. 28	5.00	5.85	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to 1/4, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.12½
Tin, 5-ton lots, New York			56.25
Lead (up to carlots), St. Louis	10.00	New York	10.12½
Zinc (up to carlots), St. Louis	6.80	New York	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	29.00	28.50
Antimony (Chinese), ton spot	11.75	13.00	10.25
Copper sheets, base	21.00	21.25	23.00
Copper wire, base	16.50	19.00	16.25
Copper bars, base	20.00	22.50	19.50
Copper tubing, base	23.00	27.25	23.00
Brass sheets, base	17.75	22.00	18.75
Brass tubing, base	22.00	27.00	20.50
Brass rods, base	15.50	18.00	15.75
Brass wire, base	18.25	22.00	....
Zinc sheets (casks)	10.75	11.00	....
Solder (½ and ½), (case lots)	38.00	41.50	30.00
Babbitt metal (83% tin)	60.00	65.00	48@52
Babbitt metal (35% tin)	28.00	21.50	22@25
Nickel (ingot and shot)	29.00	....	....
Nickel (electrolytic)	32.00	....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.00	11.00	11.50
Copper, heavy, and wire	10.75	10.50	10.75
Copper, light, and bottoms	9.75	9.50	9.75
Lead, heavy	7.75	7.00	6.00
Lead, tea	6.50	4.50	5.00
Brass, heavy, yellow	7.00		7.25
Brass, heavy, red	9.25	9.50	9.00
Brass, light	6.00	5.50	6.25
No. 1 yellow brass turnings	7.00	6.00	6.75
Zinc	4.00	3.50	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.12½	.17	.10½
Wiping cloths, 13¼x13¾, per lb	11.00	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	11.50	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.97	1.04	.94
Lard cutting oil, 25% lard, per gal.	.58	.50	.67½
Lard oil, pure, per gal, 2 to 5 bbl. lots	.80@1.35	1.01	.97
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50–5%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		4.00@4.50
Coke, prompt foundry, Connellsville	per net ton		5.25@6.50
White lead, dry or in oil	100 lb. kegs		New York, 15.00
Red lead, dry	100 lb. kegs		New York, 15.00
Red lead, in oil	100 lb. kegs		New York, 16.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0319
Cold finished shafting	per lb.	0.044	0.044	0.0405
Brass rods	per lb	0.155	0.15	0.1862½
Solder (½ and ½)	per lb.	0.3675	0.3475	0.305
Cotton waste	per lb.	.14@.21	.14@.21	.10@.1
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.58	0.55	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1½ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	45%	.....	60–5%
Square and hex. head cap screws	60%	75%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	05%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅜ and smaller	65%	.....	.....
Semi-finished nuts, ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1⅛ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$3.70 base

N. J., Plainfield—The International Photo Corp. awarded the contract for the construction of a 4 story heat treating plant. Estimated cost $500,000.

N. Y., Buffalo—The Fedders Mfg. Co., 57 Tonawanda St., plans to build an addition to its factory for the manufacture of automobile radiators. Engineer or architect not selected.

N. Y., New York—The Lenmore Realty Corp., c/o J. M. Felson, Engr. and Archt., 1133 Bway., will build a 2 story garage on Bway. Estimated cost $150,000.

N. Y., New York—The New York Telephone Co., 15 Dey St., awarded the contract for the construction of a 3 story plant on White Plains Rd. and 242nd St. Estimated cost $300,000.

N. Y., Otsego—The Angle Steel Tool Co. will build a 60 x 80 ft. addition to its plant.

N. Y., Ogdensburg—The A. H. Coplan Co., 207 Montcalm St., Hull, Que., plans to build an iron foundry west of here. Cost between $50,000 and $60,000.

N. Y., Watertown—The J. B. Wise Co., 401 Mill St., plans to rebuild and repair its plant, which was recently damaged by fire. Cost from $40,000 to $50,000. L. H. Mitchell, Mgr.

O., Canton—The Timken Roller Bearing Co., Dulber Ave., N. W., awarded the contract for the construction of a 1 story, 230 x 240 ft. addition to plant. Estimated cost $85,000. Noted Nov. 8.

O., Cincinnati — The Merkel Bros. Co., Canal and Jackson Sts., manufacturer of plumbing and heating supplies, awarded the contract for the construction of a plant, including 3 story, 100 x 320 ft. mill building, 2 story, 100 x 220 ft. pipe building, garage, etc.

O., Cleveland—The Bolivar-Prospect Co., c/o J. L. Free, 1004 Prospect Ave., awarded the contract for the construction of a 3 story, 116 x 180 ft. garage, etc., at 1300 Bolivar Rd. Estimated cost $300,000.

O., Cleveland—The Chicago Pneumatic Tool Co., 1241 East 49th St., will soon award the contract for the construction of a 3 story, 43 x 126 ft. factory. Estimated cost $60,000. T. P. Kimman, Mgr. Private plans. Noted Dec. 13.

O., Cleveland—The Fixit Body & Fender Repair Co., 2075 East 65th St., is having plans prepared for the construction of a 2 story addition to its factory on Carnegie St. Estimated cost $40,000. E. McGeorge, 3030 Euclid Ave., Archt. Noted Nov. 29.

O., Cleveland — The McCauley Storage Battery Co., c/o J. F. and C. J. McCauley, 1060 St. Clair Ave., awarded the contract for the construction of a 1 story, 35 x 128 ft. factory on Chester Ave. Estimated cost $40,000. Noted Nov. 8.

O., Cleveland—The Motor Repair & Mfg. Co., 1549 Hamilton Ave., had plans prepared for the construction of a 1 and 2 story, 20 x 60 ft. and 60 x 100 ft. factory. Estimated cost $40,000. C. Levinson, Pres. Private plans.

O., Cleveland — The Nickel Plate Fdry. Co., 14915 Woodworth Rd., awarded the contract for the construction of a 1 story, 96 x 160 ft. foundry. Estimated cost $50,000. Noted Feb. 21.

O., Cleveland—The J. Roemer Heating Co., 1808 East 22nd St., awarded the contract for the construction of a 1 story, 80 x 132 ft. addition to factory. Estimated cost $40,000. Noted Jan. 31.

O., Cleveland—The Sanymetal Products Co., 6233 St. Clair Ave., manufacturer of metal partitions, is having plans prepared for the construction of a 1 story addition to its factory on Urbana Rd. Estimated cost $40,000. R. F. Carpenter, Pres. Private plans.

O., Cuyahoga Heights (Cleveland P. O.) —The Bowler Fdry. Co., 1688 Columbus Rd, Cleveland, is having plans prepared for the construction of a 1 story, 200 x 500 ft. foundry, here. Estimated cost $200,000. J. H. Bruce, Pres. A. G. Simon, 716 Hippodrome Bldg., Cleveland, Archt.

O., Elyria—The Elyria Iron & Steel Co. is having plans prepared for the construction of a 1 story addition to its factory. Estimated cost $60,000. E. McGeorge, 3030 Euclid Ave., Cleveland, Archt.

O., Geneva — The Champion Hardware Co. is having plans prepared for the construction of a 3 story, 50 x 130 ft. addition to its plant. Lockwood, Greene & Co., Hanna Bldg., Cleveland, Engrs. and Archts.

O., Ironton—The Belfont Iron Wks. Co. plans to build an additional open hearth steel plant. Cost will exceed $50,000.

Pa., Phila.—The Atwater Kent Mfg. Co., Wissahicken and Abbottsford Aves., auto ignition, awarded the contract for the construction of a plant. Estimated cost $1,000,000.

Pa., Phila.—The Columbia Steel Equipment Co., 154 North 11th St., will build a 1 story, 29 x 55 ft. factory for the manufacturer of steel office equipment on 32nd and Winghocking Sts. Estimated cost $15,000.

Pa., Phila.—The Electric Storage Battery Co., 19th and Allegheny Sts., awarded the contract for the construction of a 1 and 2 story 80 x 120 ft. factory.

Pa., Phila.—H. S. Getty & Co., Inc., 1539 Cabot St., is having plans prepared for the construction of a 1 story, 40 x 80 ft. and 32 x 80 ft. machine shop on Stokley St. below Hunting Park Ave. Estimated cost $80,000. Walker & Carswell, 1015 Chestnut St., Archts.

Pa., Pittsburgh—The Mine Safety Appliance Co., Chamber of Commerce Bldg., awarded the contract for the construction of a 4 story, 62 x 145 ft. addition to its plant on Braddock Ave. Estimated cost $150,000.

Pa., Pittsburgh — The Pittsburgh Auto Equipment Co., 5933 Baum Bldg., awarded the contract for the construction of a 5 story factory and store. Estimated cost $100,000.

Pa., Pittsburgh—The Pittsburgh Screw & Bolt Co., Preble Ave., N. S., will build a 1 story, 100 x 250 ft. addition to its factory. Estimated cost $100,000.

Pa., Sharon—The Westinghouse Electric & Mfg. Co., East Pittsburgh, is having plans prepared for the construction of an addition to its plant, to consist of three 1 and 4 story buildings, 145 x 1,025 ft., 92 x 650 ft. and 80 x 352 ft., here. Estimated cost $1,000,000. B. H. Prack, Keystone Bldg., Pittsburgh, Archt.

Pa., Williamsport — The D. M. Page Motorcycle Co. plans to build a 2 story, 50 x 110 ft. garage on 10th Ave. and will receive bids about Apr. 1. Estimated cost $150,000.

Pa., Wilmerding—The Westinghouse Air Brake Co. awarded the contract for the construction of a 3 story, 56 x 465 ft. foundry with 35 x 80 ft. cupola building, also a 3 story, 81 x 450 ft. machine shop, etc.

R. I., Pawtucket—The city plans to build a garage and service station on Taft St. for the Street Dept. Estimated cost $100,000.

R. I., Providence—The Providence Gas Co., Weybosset Court, is having plans prepared for the construction of a meter and fitters shop, garage, etc., on Potters Ave. and Dexter St. Jenks & Ballou, 72 Weybosset St., archts.

Tenn., Knoxville—The Fulton Mfg. Co., Kingston Park, manufacturer of thermosensitive devices, awarded the contract for the construction of an addition to plant. Estimated cost $40,000.

Tex., Dallas—Wofford & Lipsitz, Western Indemnity Bldg., awarded the contract for the construction of a 3 story, 210 x 287 ft. garage on Pacific St. Estimated cost $150,000.

Tex., San Antonio—S. L. Jeffers, 1 Bushnell Pl., is having plans prepared for the construction of a 4 story, 65 x 212 ft. garage on Ave. E and 3rd St. Estimated cost $150,000. H. T. Phelps, Hicks Bldg., Archt.

Va., Portsmouth—The Southern Wheel Co., Railway Exch. Bldg., St. Louis, Mo., awarded the contract for the construction of a 1 story, 90 x 150 ft. car wheel foundry, here. Estimated cost $125,000.

Wis., Kewaunee — The Leyse Aluminum Co. plans to build a 2 story addition to its factory. Estimated cost $40,000. Engineer or architect not selected.

Wis., Milwaukee — F. D. Chase, Inc., Engr. and Archt., 645 North Michigan St., Chicago, will receive bids until Mar. 15 for the construction of a 1 and 3 story, 82 x 160 ft. foundry for the Prime Mfg. Co., 653 Clinton St., manufacturer of railroad supplies, here. Noted Dec. 6.

Wis., Milwaukee—The Northern Conveyor & Mfg. Co., 3204 American Ave., plans to build a 1 story, 98 x 250 ft. factory. Engineer or architect not selected.

Ont., Hamilton—The Canadian Westinghouse Co., Aberdeen St., W., awarded the contract for the construction of a 1 story, 100 x 500 ft. foundry. Estimated cost $400,000.

Ont., St. Thomas—The Canadian Natl. Ry., 230 St. James St., Montreal, Que., C. B. Brown, Ch. Engr. and the Wabash Ry., Railway Exch. Bldg., St. Louis, Mo., R. H. Howard, Ch. Engr., are preparing plans and will receive bids about Apr. 1 for the construction of locomotive shops and round house, here. Estimated cost $220,000.

Wis., Milwaukee—Northern Conveyor & Mfg. Co., 3204 American Ave.—machinery and tools for proposed plant.

You Will Find

The Latest Equipment Opportunities
Business Opportunities
Employment Opportunities

In the

SEARCHLIGHT SECTION

See Pages 178 to 187